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THE PHILOSOPHY OF CLOTHING.

By W. MATTIEU WILLIAMS.

VII.—RUMFORD'S EXPERIMENTS ON CLOTHING MATERIALS.

THE experiments already described were directed to the determination of the relative protecting power of different materials. These were followed by another series upon certain given materials differently arranged, or in different conditions of density. The same "passage thermometer" was used. The question to be determined was, whether the protecting power of the substances used in the previous experiments was due to the non-conduction of the material of those substances themselves, or whether the air imprisoned between their fibres was an important factor. If the silk, wool, cotton, &c., did all the obstructive work independently of the air, then the amount of obstruction should vary with the quantity of fibre. As, in the experiments already described, the fibres were loosely arranged round the bulb of the thermometer, it was easy to increase their quantity by packing them more closely, and yet retaining the other conditions of bulk, &c., the same.

The material selected for the first series of experiments was eider-down. It was placed round the bulb of the thermometer, occupying the space between it and the outer globe, but so packed that the quantities therein were 16 grains, 32 grains, and 64 grains respectively in the different experiments. The following were the results, the times of cooling shown in seconds:—

Heat lost, or Amount of Cooling	Sixteen Grains.	Thirty-two Grains.	Sixty-four Grains.
70°	—	—	—
60	97″	111″	112″
50	117	128	130
40	145	157	165
30	192	207	224
20	267	304	326
10	486	565	658
Total times.	1304	1472	1615

It is evident from these results that the protective power does not increase nearly in the same proportion as the quantity of material when packed in the same space. Had such been the case, and the rate of cooling proportionately retarded, the time for 64 grains should have been $1,304 \times 4 = 5,216$ seconds instead of only 1,615 seconds.

The following displays the results obtained by using the same material, in the same quantity, but differently disposed. The first-named, the raw silk, was very fine, and equally distributed throughout the space it occupied; the second, the ravellings of taffety, were also fine, but not so fine as the raw silk, and, of course, the interstices between its threads were greater; the cuttings of sewing silk on the third were very coarse, and, consequently, the material was very unequally distributed in the space in which it was confined. In the fourth the same quantity of sewing-silk, instead of being distributed through the space between the bulb and globe, was wound round the bulb of the thermometer, forming a tightly-fitting jacket, entirely covering it, and as nearly as possible of the same thickness in every part. The time of cooling each 10 degrees is shown in seconds.

Heat lost, or amount of cooling.	Raw Silk.	Ravellings of Taffety.	Sewing-silk cut into lengths.	Sewing-silk wound round bulb.
70°	—	—	—	—
60	94″	90″	67″	46″
50	110	106	79	62
40	133	128	99	85
30	185	172	135	121
20	273	246	195	191
10	489	427	342	399
Total times.	1248	1169	917	904

Here the clothing efficacy of a given quantity of silk is shown to diminish with its closeness of texture.

There is, however, a curious anomaly displayed by these experiments. The protective superiority of the loosely-arranged fibres of silk is greater at the first cooling down from the higher temperatures, and gradually diminishes as the temperature lowers. This is the most strikingly shown by comparing the fourth and fifth columns, the loose sewing-silk and the tightly-wrapped sewing-silk. Between 70° and 60° the superiority of the loose silk is as 67 to 42; this ratio diminishes progressively until equality is nearly reached between 30° and 20°—*i.e.*, 195 to 191. Between 20° and 10° the relations are reversed, the tightly-wound silk having the advantage in the ratio of 399 to 342. That this is not an error of experiment, or a peculiarity of silk, was shown by subsequent experiments on other materials.

The quantity used in the following experiments were the same as before, viz., 16 grains; the sheep's wool, cotton wool, and lint placed round the bulb of the thermometer, filling the space between it and the outer globe; the different kinds of thread wound closely round, and the fine linen cloth wrapped nine times round the bulb, and bound together at the top and bottom, so as to cover it.

Heat lost, or amount of cooling.	Sheep's Wool, loose.	Woollen thread wound round bulb.	Cotton Wool, loose.	Cotton thread wound round bulb.	Lint, loose.	Linen thread wound round bulb.	Linen cloth wrapped round bulb.
70°	—	—	—	—	—	—	—
60	79″	46″	83″	45″	80″	46″	42″
50	95	63	95	60	93	62	56
40	118	89	117	83	115	83	74
30	162	126	152	115	150	117	108
20	238	200	221	179	218	180	168
10	426	410	378	370	376	385	338
Tl. times	1118	934	1046	852	1032	873	786

Here, again, the difference diminishes as the temperature decreases, but not so remarkably as in the case of the silk.

Rumford was surprised at this, and says, "From hence it should seem that a covering may, under certain circumstances, be very good for confining small degrees of warmth, which would be but very indifferent when made use of for confining a more intense heat, and *vice versâ*." He adds, "This, I believe, is a new fact, and I think the knowledge of it may lead to further discoveries relative to the causes of the warmth of coverings, or the manner in which heat passes through them."

I must pass over the details of other experiments made with charcoal, lycopodium, lamp-black, wood-ashes, &c. He selected charcoal because it "is supposed to be composed almost entirely of phlogiston," his object being to determine whether "that principle was the cause either of the conducting power, or the non-conducting power of bodies which contain it." (This was written in 1787, when phlogiston occupied a place in the scientific imagination similar to that which is now held by the luminiferous ether. Rumford subsequently renounced it.)

The results with these powders were similar to those with the fibres. The more finely-divided and looser the material the greater the resisting power. Thus lamp-black was more resistant than powdered charcoal, and the lycopodium ("*semen lycopodii*"), or "witch meal," which is an excessively fine and light powder, and greatly excelled them both.

As in all these experiments there was air as well as the fibres or powders, the materials for answering the question of the relative resisting power of the solids and the gas were in hand, but on examination of the results a curious paradox presented itself.

Comparing the resisting power of the air itself, when that alone filled the bulb, with that of the same space containing a mixture of air and fibres, the resisting action was increased by the introduction of the fibres to an extent exceeding that which would be due to them if they were not merely bad conductors of heat, but absolute non-conductors. "Their volumes or solid contents were so exceedingly small in proportion to the capacity of the globe in which they were placed, that, had they had no effect whatever upon the air filling their interstices, that air would have conducted all the heat communicated in less time than was actually taken up in the experiment."

In the case of the raw silk having a specific gravity of 1,734 (water 1000) the volume of the 16 grains was=0·037294 of a cubic inch, while the space between the bulb of the thermometer and the outer globe amounted to 2·05755 cubic inches. The silk was distributed so as to apparently fill this space, and yet occupied but $\frac{1}{55}$ of it.

In the first experiment, when the space between the bulb of the thermometer and the glass globe, in the centre of which it was confined, was filled with nothing but air, the time taken up by the thermometer in cooling from 70° to 10° was 576 seconds, but when this same space was filled with 54 parts of air and 1 part of raw silk, the time of cooling was 1,284 seconds. A similar quantity of eider-down raised it from 576 to 1,304 seconds, while four times as much eider-down only brought it to 1,615 seconds.

The dilemma is thus stated by Rumford:—"Now, supposing that the silk had been totally incapable of conducting any heat at all, if we suppose at the same time that it had no power to prevent the air remaining in the globe from conducting it, in that case its presence in the globe could only have prolonged the time of cooling in proportion to the quantity of air it had displaced to the quantity that remained, that is to say, as 1 is to 54, or a little more than 10 seconds. But the time of cooling was actually prolonged 708 seconds; and this shows that the silk not only did not conduct the heat itself, but that it prevented the air, by which its interstices were filled, from conducting it, or, at least, it greatly weakened its power of conducting it."

This presents the questions which Rumford next proceeded to answer experimentally:—"How can air be prevented from conducting heat? And this necessarily involves another, which is, *How does air conduct heat?*"

The answers given by the air itself when put to the torture by Rumford will be stated in my next. Their fundamental bearing upon the present subject will then be seen.

A DARING LOTTERY SWINDLE.

By Richard A. Proctor.

NOTHING in the history of gambling seems to me to speak more strongly of man's tendency to this vice, and of his blindness and folly in its pursuit, than the State Lottery of Louisiana. This lottery is the only one of the kind now permitted in the United States, and even this is as far as possible limited in its action to the State of Louisiana, the Government of Washington preventing the postal service of the nation (as far as possible) from being used for this gross swindle. But the lottery thrives all the same. It is advertised in hundreds of papers, and always in such terms as amount in reality to the admission that it is a swindle. I have one of these amazing advertisements before me. It announces that 100,000 tickets are sold, each at 5 dols., but shares can be bought in proportion. It states that two Commissioners—Generals Beauregard and Early—manage the drawings, and that these drawings are conducted with fairness and honesty and in good faith to all parties. And then it states the value of the prizes. The total value of all the prizes amounts to 265,000 dols. Supposing all the tickets sold, the balance of profit amounts to 235,000 dols. From this monthly profit deduct 1,000 dols. paid to each Commissioner monthly, and say 1,000 dols. monthly for advertising, or 3,000 dols.; and deduct further 2,000 dols. for all other expenses. The balance, 230,000 dols. is the monthly profit. This gives an income of 2,760,000 dols., or £550,000, if all the tickets are disposed of each month, and this without a particle of risk. It is urged by some that as there is always the probability that some tickets may remain unsold, this profit is not certain. I am told that nearly the full number of tickets are sold each month. But in reality the character of the swindle is not at all affected by the chance that in bad times the total number of tickets may not be purchased. The monthly profits may be diminished, but the transaction is as rascally, let the number of tickets sold be what it may. This is carefully hidden under the assurance that whatever the number of sold tickets all the prizes are distributed, after the drawings have been made. This is actually done. But the 100,000 numbers are all distributed first, those sold being distributed to their respective buyers, those unsold to the company; the company take their chance on these with the rest, and, in the long run, win their due proportion of the numbers thus left in their hands. Consider how this works. Suppose 50,000 tickets sold and the rest left in the company's hands—though they seldom have so many tickets left over as this. Then the company receive 250,000 dols. for the tickets sold. On these tickets they have to pay all prizes falling to the ticket-holders, and, taking one month with another for long periods of time, the value of prizes thus drawn for half the number of tickets would be half the total value of all the

prizes, or 132,500 dols., the other half being drawn for the numbers held by the company. This half is paid in full like the other; but paying it in full means handing it over to the company out of their own capital. The balance of profit for the month is thus 117,500 dols., or the net profits 112,000 dols., assuming the above liberal allowance for expenses. It is probable that the net monthly profits never fall short of 100,500 dols., or £240,000 per annum.

Yet though the swindling nature of the whole transaction is thus not only obvious, but, as it were, practically insisted upon in the advertisements of the company, fools rush in, in myriads monthly, to pay their five dollars for chances worth but two dollars sixty-five cents. If a man held an open lottery, to which each of one hundred persons admitted paid £5, and taking the sum of £500 thus collected, were to say—"The lottery, gentlemen gamblers, will now proceed; £265 of the sum before me, I will distribute in prizes, as follows" (indicating how it would be divided); "the rest, the sum of £235 which I have here separated, I will put into my own pocket" (suiting the action to the word), "for my trouble in getting up this lottery"—it strikes me the "gentlemen gamblers" would object to the arrangement. Yet the Louisiana lottery swindle does this very thing on a larger scale month after month; and each year hundreds of thousands, greedy to be rich without labour, pour in their five dollars apiece in an endless stream. And the State of Louisiana not only allows this gross swindle to go on, but the lottery is a State lottery, and has been "incorporated by the Legislature of Louisiana for education and charitable purposes."—*Newcastle Weekly Chronicle.*

CRITICAL METHODS OF DETECTING ERRORS IN PLANE SURFACES.

By JOHN A. BRASHEAR.

(*Continued from p.* 348.)

I NOW invite your attention to the method for testing the flat surfaces on which Professor Rowland rules the beautiful diffraction gratings now so well known over the scientific world, as also other plane surfaces for Heliostats, &c. I am now approaching the borderland of what may be called the abstruse in science in which I humbly acknowledge it would take a vast volume to contain all I don't know, yet I hope to make plain to you this most beautiful and accurate method, and for fear I may forget to give due credit, I will say that I am indebted to Dr. Hastings for it, with whom it was an original discovery, though he told me he afterwards found it had been in use by Steinheil, the celebrated optician of Munich. The principle was discovered by the immortal Newton, and it shows how much can be made of the ordinary phenomena seen in our everyday life when placed in the hands of the investigator. We have all seen the beautiful play of colours on the soap bubble, or when the drop of oil spreads over the surface of the water. Place a lens of long curvature on a piece of plain polished glass, and, looking at it obliquely, a black central spot is seen with rings of various width and colour surrounding it. If the lens is a true curve, and the glass beneath it a true plane, these rings of colour will be perfectly concentric and arranged in regular decreasing intervals. This apparatus is known as Newton's colour-glass, because he not only measured the phenomena, but established the laws of the appearances presented. I will now endeavour to explain the general principle by which this phenomena is utilised in the testing of plane surfaces. Suppose that we place on the lower plate lenses of constantly increasing curvature until that curvature becomes *nil*, or, in other words, a true plane. The rings of colour will constantly increase in width as the curvature of the lens increases, until at last one colour alone is seen over the whole surface, provided, however, the same angle of observation be maintained, and provided further that the film of air between the glasses is of absolutely the same relative thickness throughout. I say the film of air, for I presume that it would be utterly impossible to exclude particles of dust so that absolute contact could take place. Early physicists maintained that absolute molecular contact was impossible, and that the central separation of the glasses in Newton's experiment was $\frac{1}{250000}$ of an inch, but Sir William Thompson has shown that the separation is caused by shreds or particles of dust. However, if this separation is equal throughout, we have the phenomena as described, but if the dust particles are thicker under one side than the other our phenomena will change

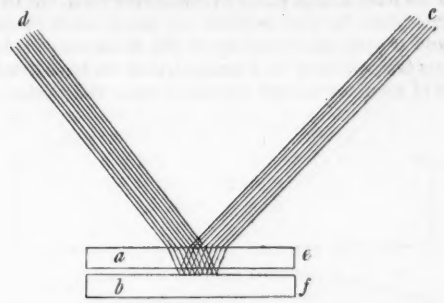


Fig. 7.

to broad parallel bands, as in Fig. 8, the broader the bands the nearer the absolute parallelism of the plates. In Fig. 7 let *a* and *b* represent the two plates we are testing. Rays of white light *c*, falling upon the upper surface of plate *a*, are partially reflected off in the direction of rays *d*; but, as these rays do not concern us now, I have not sketched them. Part of the light passes on through the upper plate, where it is bent out of its course somewhat, and, falling upon the lower surface of the upper

Fig. 8.

plate, some of this light is again reflected toward the eye at *d*. As some of the light passes through the upper plate, and, passing through the film of air between the plates, falling on the upper surface of the lower one, this in turn is reflected, but as the light that falls on this surface has had to traverse the film of air twice, it is retarded by a certain

number of half or whole wave lengths, and the beautiful phenomena of interference takes place, some of the colours of white light being obliterated while others come to the eye. When the position of the eye changes the colour is seen to change. I have not time to dwell further on this part of my subject, which is discussed in most advanced works on physics, and especially well described in Dr. Eugene Lommel's work on the "The Nature of Light." I remarked that if the two surfaces were perfectly plane there would be one colour seen, or else colours of the first or second order would arrange themselves in broad parallel bands, but this would also take place in plates of slight curvature for the requirement is as I said, a film of air of equal thickness throughout. You can see at once that this condition could be obtained in a perfect convex surface fitting a perfect concave of the same radius. Fortunately we have a check to guard against this error. To produce a perfect plane three surfaces must be worked together unless we have a true plane to commence with, but to make this true plane by this method we must work three together, and if each one comes up to the demands of this most rigorous test, we may rest assured that we have attained a degree of accuracy almost beyond human conception. Let

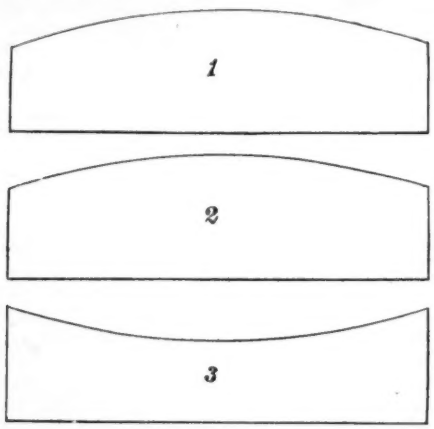


Fig 8*a*.

me illustrate. Suppose we have plates 1, 2, and 3, Fig. 8*a*. Suppose 1 and 2 to be accurately convex and 3 accurately concave, of the same radius. Now it is evident that 3 will exactly fit 1 and 2, and that 1 and 2 will separately fit No. 3, but when 1 and 2 are placed together they will only touch in the centre, and there is no possible way to make three plates coincide when they are alternately tested upon one another than to make perfect planes out of them. As it is difficult to see the colours well on metal surfaces, a one-coloured light is used, such as the sodium flame, which gives to the eye, in our test, dark and bright bands instead of coloured ones. When these plates are worked and tested upon one another until they all present the same appearance, one may be reserved for a test-plate for future use. Here is a small test-plate made by the celebrated Steinheil, and here two made by myself, and I may be pardoned in saying that I was much gratified to find the coincidence so nearly perfect that the limiting error is much less than ·00001 of an inch. My assistant, with but a few months' experience, has made quite as accurate plates. It is necessary, of course, to have a glass plate to test the metal plates, as the upper plate must be transparent. So far we have been dealing with perfect surfaces. Let us now see what shall occur in surfaces that are not plane. Suppose we now have our perfect test-plate, and it is laid on a plate that has a compound error, say depressed at centre and edge and high between these points. If this error is regular the central bands arrange themselves as in Fig. 9. You may now ask, how are we to know what sort of

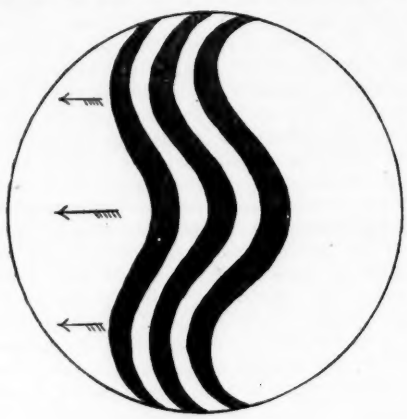


Fig. 9.

surface we have. A ready solution is at hand. The bands always travel in the direction of the thickest film of air, hence, on lowering the eye, if the convex edge of the bands travel in the direction of the arrow, we are absolutely certain that that part of the surface being tested is convex, while if, as in the central part of the bands, the concave edges advance, we know that part is hollow or too low. Furthermore, any small error will be rigorously detected, with astonishing clearness, and one of the grandest qualities of this test is the absence of "personal equation" for, given a perfect test-plate, it won't lie, neither will it exaggerate. I say, won't lie, but I must guard this by saying that the plates must coincide absolutely in temperature, and the touch of the finger, the heat of the hand, or any disturbance whatever will vitiate the results of this lovely process; but more of that at a future time. If our surface is plane to within a short distance of the edge, and is there overcorrected, or convex, the test shows it as in Fig. 10. If the whole surface is regularly convex then

Fig. 10.

concentric rings of a breadth determined by the approach to a perfect plane are seen. If concave, a similar phenomena is exhibited except in the case of the convex the broader rings are near the centre, while in the concave they are nearer the edge. In lowering the eye

while observing the plates, the rings of the convex plates will advance outward, those of the concave inward. It may be asked by the mechanician, Can this method be used for testing our surface plates? I answer, that I have found the scraped surface of iron bright enough to test by sodium light. My assistant in the machine work scraped three 8 in. plates that were tested by this method and found to be very excellent, though it must be evident that a single cut of the scraper would change the spot over which it passed so much as to entirely change the appearance there, but I found I could use the test to get the general outline of the surface under process of correction. These iron plates, I would say, are simply used for preliminary formation of polishers. I may have something to say on the question of surface plates in the future, as I have made some interesting studies on the subject. I must now bring this paper to a close, although I had intended including some interesting studies of curved surfaces. There is, however, matter enough in that subject of itself, especially when we connect it with the idiosyncrasies of the material we have to deal with, a vital part of the subject that I have not touched upon in the present paper. You may now inquire how critical is this "colour test." To answer this I fear I shall trench upon forbidden grounds, but I call to my help the words of one of our best American physicists, and I quote from a letter in which he says, "by combined calculation and experiment I have found the limiting error for white light to be $\frac{1}{8000000}$ of an inch, and for Na (or sodium) light about fifty times greater or less than $\frac{1}{800000}$ of an inch." Dr. Alfred Mayer estimated and demonstrated by actual experiment that the smallest black spot on a white ground visible to the naked eye is about $\frac{1}{800}$ of an inch at the distance of normal vision, namely 10 inches, and that a line, which, of course, has the element of extension $\frac{1}{8000}$ of an inch in thickness could be seen. In our delicate "colour test" we may decrease the diameter of our black spot a thousand times, and still its perception is possible by the aid of our monochromatic light, and we may diminish our line ten thousand times, yet find it just perceivable on the borderland of our test by white light. Do not presume I am so foolish as to even think that the human hand directed by the human brain can ever work the material at his command to such a high standard of exactness. No; from the very nature of the material we have to work with, we are forbidden even to hope for such an achievement, and could it be possible that, through some stroke of good fortune, we could attain this high ideal, it would be but for a moment, as from the very nature of our environment, it would be but an *ignus fatuus*. There is, however, to the earnest mind a delight in having a high model of excellence, for as our model is so will our work approximate, and although we may go on approximating our ideal for ever we can never hope to reach that which has been set for us by the great Master Workman.

THOUGHT AND LANGUAGE.

By ADA S. BALLIN.

VIII.

WE have seen how the primitive language of sensation gradually developed into that of emotion, and how from the basis thus formed the language of the will arose. In my last article we were left in that no man's land which lies between actions expressive of will and those which serve to communicate thought; for it is impossible to fix a definite line between the various phases of mind and their manifestations. Equally difficult is it to define those gestures which man and no other animal is capable of performing, as there are endless examples recorded of gestures of a very complicated character that could only be the result of complex intellectual acts having been performed by the lower animals.

The following very striking and mutually corroborative instances will, I think, illustrate this point. Captain Johnson saw a number of monkeys (*Macacus rhesus*) on some trees, and he says:—"I fired with small shot at one of them, which instantly ran down to the lowest branch of the tree, as if he were going to fly at me, stopped suddenly, and coolly put his paw to the part wounded, covered with blood, and held it out for me to see."* The action said as plainly as possible, "See what a dreadful injury you have done me," and Captain Johnson was so impressed by the mute reproach that he has never since fired at any of the tribe.

The second case is given by Jesse, and refers to Sir W. Hoste's Memoirs:—"One of his officers, come home after a long day's shooting, saw a female monkey running along the rocks with her young one in her arms. He immediately fired, and the animal fell. On his coming up, she grasped her little one close to her breast, and with the other hand pointed to the wound which the ball had made, and which had entered above her breast. Dipping her finger in the blood, and then holding it up, she seemed to reproach him with being the cause of her death, and consequently that of the little one, to which she frequently pointed. 'I never,' says Sir William, 'felt so much as when I heard the story, and I determined never to shoot one of these animals as long as I lived.'"†

A similar story is told of the celebrated elephant Chuny. When he was brought to England in 1810 he was engaged to perform at Covent Garden Theatre. It was arranged that in the course of the performance he should pass over a bridge. The bridge was not very strongly built, and the animal, feeling it unequal to his weight, resolutely refused to cross it. Blow after blow from an iron goad rained upon the fleshy part of his neck at the root of the ear, until quite a pool of blood was made on the floor. At last Capt. Kay, who had brought Chuny over on his ship, the *Ashel*, and had petted him a great deal, came to know what was the matter. Before any explanation could be given, Chuny walked up to him, caught his friend's hand in his trunk, thrust it into the bleeding wound, and then held it up before his eyes, thus attracting his attention to the cruelty which had been practised.

The reasoning in this case is precisely what is called human reasoning, and the comprehension of the relation of cause and effect is very strongly marked; the gestures described are also exactly what would be performed by a deaf-and-dumb person under the same circumstances.

Another instance, less tragic, but proving even more conclusively the power of reasoning and communication, was received by Mr. Romanes from Lieut.-General Sir John H. Lefroy, C.B., K.C.M.G., F.R.S., who has a terrier which it is the duty of his wife's maid to wash and feed. "It was her habit, after calling her mistress in the morning, to go out and milk a goat which was tethered near the house, and give "Button" the milk. One morning, being rather earlier than usual, instead of going out at once, she took up some needlework, and began to occupy herself. The dog endeavoured in every possible way to attract her attention and draw her forth, and at last pushed aside the curtain of a closet, and, never having been taught to fetch or carry, took between his teeth the cup she habitually used, and brought it to her feet."

* "Animal Intelligence," p. 475.

† "Gleanings," Vol. III., pp. 86-7.

XUM

Those gestures which express thought imply a far higher stage of mental development than any of the other gestures which we have been considering. Man has full possession of those involuntary gestures which express feelings, and of the gestures which express volition. He has these in common with inferior animals; but he has more than these, for the mind of the most savage man transcends that of the most cultured brute, although the difference is one of degree only. Thus Mr. Galton observes* that the Dammaras are able to count as far as three only; they discover the loss of an ox, "not by the number of the herd being diminished, but by the absence of a face they know." If two sticks of tobacco are "the rate of exchange for one sheep, it would sorely puzzle a Dammara to take two sheep and give him four sticks;" and he continues: "Once while I watched a Dammara floundering hopelessly in a calculation on one side of me, I observed Dinah, my spaniel, equally embarrassed on the other. She was overlooking half-a-dozen of her new-born puppies; and her anxiety was excessive as she tried to find out if all were present. . . . She kept puzzling and running her eyes over them, backwards and forwards. She had evidently a vague notion of counting, but the figure was too large for her brain. Taking the two as they stood, dog and Dammara, the comparison reflected no great honour on the man."

Differences of degree, however, widen so greatly that in the course of time they become to all seeming differences in kind. Thus, in animals and plants a slight variation from an original type may become so perpetuated and encouraged by natural selection or surrounding conditions that they may eventually appear to belong to a wholly separate genus.

The inherent similarity between brute and human intelligence has been tacitly or explicitly acknowledged in all ages. In those beast-fables which have been found all over the world, human characteristics have been attributed to the lower animals; and, curiously enough, that most human of all attributes—articulate speech—has been ascribed to them by many and various nations. Familiar instances of this are the talking serpent of Genesis,† Balaam's ass,‡ and the characters in Æsop's Fables; but less well known is the shark of Polynesian myth, which speaks and acts like a human being. The pelican and musk-duck, according to an Australian legend, are capable of human speech and action; and in South African legends, not only do all animals speak, but the various kinds are credited with different modes of pronunciation.

In antithesis to this belief in the possession of human faculties by the brutes, may be regarded the prominent doctrine still in existence, that an inseparable barrier exists between the lower animals and man, a doctrine which, put shortly, is that the man possesses a soul, while the animal, not having that gift, is a mindless automaton. The supporters of the Evolution theory, however, regard the mind of man as a direct development from that of the lower animals; they maintain that from the earliest trace of a nervous system, which is now found represented in the Medusæ, there has been a process going on through countless successive generations that has brought about the gradual specialisation of a nervous system, which, becoming more and more complicated at every step, has taken on functions of greater complexity, till we have reached the brain of a Shakespeare or a Bacon. This, too, is a hopeful theory, for, having got so far, why should we not go farther in the march of intellect?

* "Tropical Africa," p. 132. † Chap. iii.
‡ Numbers, xxii., 28 *et seq.*

Against the conclusion of my second article, "That man's mind was developed by the struggle for existence," *ex hyp. evolut.*, a correspondent, "Hallyards" [1626], has formulated the pseudo-syllogism, "all other races are older than man. *No* other races have developed mentally like man, though *all* have been struggling (and successfully) for existence longer than he has. *Ergo*, man's mental superiority is *not* the result of these circumstances, but is itself the efficient cause of his use of firearms, language, and of his domination over all other animals." I simply take this as a type of the arguments commonly used to support the doctrine of the special creation of the mind of man, although it is perhaps unjust to take so illogical a specimen, for it is obvious that the conclusion therein given cannot possibly be arrived at from its premisses.

It has never been attempted to show that other races have developed mentally like man; but it has already been pointed out that man's use of weapons, language, &c., and domination over other animals was a manifestation of his mental superiority which had been attained in the struggle for existence. There are various kinds of development which lead to success in the struggle for existence. Mental development is only one of these.

Thus we find a leaf-caterpillar has developed a green colour, which prevents its being conspicuous to its enemies, the birds; while, in the same way, another kind of caterpillar has come to resemble a piece of dried twig. The hare has gained swiftness, the skunk a malodorous secretion, the porcupine quills, the adder its poison-glands. In short, volumes might be written, only detailing these myriad protective developments. Briefly, I will formulate my argument as follows:—All animals that have survived have been enabled to do so in virtue of developing a protection against adverse surrounding circumstances. Man has survived; therefore man must have developed a protection against adverse surrounding circumstances. Some animals develop one kind of protection, some another; development in man has taken place by way of the nervous system, he has gained brain-force, and consequently mental superiority, and this mental superiority has been the means of his devising weapons, tools, clothes, and all the other implements of civilisation and life in a community, for which life language is one of the most important conditions. The question is often raised, "Why do not the lower animals develop language?" The answer is that they have not attained sufficient complexity of mental and communal life to need such a means of expression as language, such as we know it. Language in a general sense they do possess—a means of communication sufficing for their necessities. Articulate speech has grown up with the mind of man and could not exist without it.

THE EVOLUTION OF THE SENSE OF BEAUTY.

By Constance C. W. Naden.

(*Continued from page* 344.)

LET us now investigate somewhat more in detail the pleasures and pains given by *light and shade*, by *colour*, and by *form*. The discrimination of colour doubtless succeeds that of light and shade, but it will be more conveniently treated first.

I must briefly explain the "Young-Helmholtz" hypothesis, which is good till a better is suggested; but it scarcely claims to be more than a symbolic expression of

facts, and its correctness or incorrectness will not affect the validity of the general theory set forth in this paper.

It is supposed that every part of the retina is furnished with three kinds of nerve-fibres. The first set is chiefly stimulated by the longest ether-waves, producing the sensation of *red*, the second by those of medium length, giving *green*, the third by the shortest, giving *violet*. The sensations of yellow, blue, and orange are each produced by the simultaneous stimulation of *two* of these sets of fibres. For instance, those ether waves which are shorter than the red waves, and longer than the green waves, stimulate moderately both those fibres which perceive red, and those which perceive green, and give the sensation of *yellow*. Stimulation of all these sets gives *white*. A perfectly pure colour is never perceived, because while light-waves of any given length are *strongly* exciting their own special nerve-fibres, they are also very *weakly* exciting fibres of the two other kinds. The longest waves, for example, which strongly stimulate the red fibres, at the same time faintly stimulate the green and the violet fibres, so that the red always appears mixed with a little white.

But this faint excitement is not sufficient to cause fatigue. After an object of any definite colour has been presented to the eye for an appreciable time, the fibres which have been comparatively idle while their companions have been exhausted will be fresh and eager for action.

If we look at a bright red object, and then turn our eyes to a white surface, a bluish-green image will appear of the same size and shape as the original object. The red nerves have been tired, and only the green and violet nerves are acting; so that practically only the green and violet constituents of white light will be seen by that part of the retina which has been exposed to the red light. The colour of the image is said to be *complementary* to that of the object, because their mixture would form white light.

We now have data on which to explain both the pleasure in isolated colours and the pleasure in contrasted colours. A single pure, bright colour pleases for a time, because it stimulates powerfully, and yet permits a partial rest; but a contrast of colours gives a greater and more lasting pleasure, since it occasions easy and varied action. When the red waves, for instance, have fatigued the delicate structures which receive them, the complementary bluish-green waves are welcomed as a relief and diversion. The red-perceiving fibres rest and undergo repair while the others are exercised. It may be objected that a red and a bluish-green object, placed in juxtaposition, do not affect the same part of the retina. The eye, however, is never kept perfectly steady, but ceaselessly wanders from point to point, so that the pleasure derived from chromatic combination is generally due to what is known as *Successive Contrast*.

Simultaneous contrast, or the effect of one colour in heightening or modifying another, when both are seen at the same instant, produces much the same results, but seems to be attributable to a different cause. Here we are concerned with deception of the judgment rather than with retinal fatigue, since pale hues, differing little, produce a greater effect upon each other than intense hues, differing much. It seems likely that we unconsciously accept the colour of the larger mass as our standard, and accept it the more readily as it approaches nearer to white. A strip of grey paper on a sheet of pale green paper will look reddish, because it reflects more red light than is reflected by the green sheet. It should be remembered that white is merely a relative term, and that as each set of light-waves stimulates to some extent all three sets of nerves, every colour which is seen differs from white not in kind, but in degree. All ordinary colours, that is, are grades of white. Any pleasure given by simultaneous contrast must obviously be mental rather than purely sensuous.

The explanation of colour discord seems a little difficult. Mr. Grant Allen suggests* that while the red-perceiving fibres are rested by green, they are fatigued by orange or yellow, which continue the stimulation, though in a somewhat slighter degree, and thus make fresh demands upon their wearied energies. Continued contemplation of the same colour overworks the nerves which perceive it, and lessens its apparent brilliancy. The same is true, in a less degree, of continued contemplation of colours standing near each other in the chromatic scale—as, for instance, red and orange. Yet the sufficiency of this explanation seems at least doubtful. The discomfort created by discord certainly is not very similar to our feeling of fatigue, when we gaze long at an uninterrupted mass of one colour. Mr. Sully, in a criticism of "Physiological Æsthetics,"† points this out, and urges that the weariness and consequent distaste should on this theory be *greatest* when the colour is monotonous. Mr. Allen replies that our eyes seek the *boundary* of each colour, and that thus they keep travelling to and fro between the two, instead of escaping into black, white, or neutral tint, as they might were there but one hue, with an uncoloured boundary. It may still be asked,—When the eyes have reached the limit of the red, why should they not go straight on to the opposite limit of the orange? They would be *less* fatigued by thus travelling across a small patch of red and a small patch of orange than by journeying from end to end of a uniform patch of red large enough to cover both the small patch of red and the small patch of orange. If, on the other hand, they travel back again, they will not be more tired by a double journey across the small red patch, than by a single journey across the large red patch. Besides, if the feeling of discord arises from this species of fatigue, a strong eye, able to bear much stimulation, ought to suffer less from discord than a delicate eye; but we find that the eye is affected in proportion to its *cultivation*, not in proportion to its weakness. A gradation from red to orange is absolutely pleasant; and yet, on Mr. Allen's hypothesis it should be only one degree less painful than monotony.

Discord of colour probably gives a negative rather than a positive discomfort; a disappointment rather than a pain. We have a certain variety of colour, but we do not get the treat which we expected, and which we should have received from those combinations known as harmonious. Instead of appearing *brighter* by contrast, the tints actually appear duller. Consequently, we are dissatisfied. The effect is much like that of a false rhyme.

However, there may be some physical disturbance as well, and I venture to suggest a theory. The fibres which have been excited by red are still excited by the neighbouring patch of orange; but they are now called upon to respond to light waves of a slightly different length. There may be some discomfort attendant on the sudden necessity of accommodation to this new stimulus, while the vibrations due to the old stimulus still persist. This discomfort will last till the red vibrations have ceased, and the fibres are tuned for orange, and will recur when they have again to be tuned for red. It will be remembered that *smoothness* or *continuity* is one of the essential conditions of easy action.

In *gradation* this condition is fulfilled. The transition from red to orange is made almost imperceptibly, giving

* "Physiological Æsthetics," p. 167. † *Mind*. July, 1879.

time for the fibres to accommodate themselves to the fresh light waves. "All good colour," Ruskin tells us, "is gradated. A blush-rose (or, better still, a blush itself, is the type of rightness in arrangement of pure hue." The painfulness of very crude contrast probably arises partly from over-stimulation of too sensitive a structure, and partly from the too sudden withdrawal of the stimulus from one set of structures, and the equally sudden excitement of another set.

It will now be well understood that the enjoyment of gradated *light and shade* is due to a gradual passing of action into rest and rest into action. The disagreeable effect of flickering must be noticed, because the explanation offered by Mr. Grant Allen seems at least inadequate. He says, "All intermittent and jerky stimulation of the optic nerve is unpleasant, because it attacks the fibres just as they are freshly repaired, and therefore most sensitive. To this class belong the unpleasant effects of flickering and unsteady lights." This may be partly correct, but if it be wholly correct flickering ought to be actually pleasant, when the light is very faint. For supposing that the brightest light of the flicker is only strong enough to stimulate the freshly-repaired fibre, just as much as ordinary sunshine would stimulate a fibre somewhat blunted by exposure to daylight, the resulting sensation ought to resemble that produced by the soft radiance of a spring morning. Certainly it ought not to be more painful than the stimulus given by green to "freshly-repaired" fibres which have stood nearly idle while their neighbours have been receiving waves of red.

It seems that we must again take into consideration the principle of smoothness and continuity. When we look at a flickering candle or lamp, the pupil, contracted at any particular moment to the degree required by the intensity of the light which it receives, is suddenly called upon to dilate, in order to admit a greater amount of fainter light. It has not quite adapted itself to its new circumstances when a stronger stimulus obliges it again to contract, and before it has quite accomplished this task, again it is required to dilate. If the illumination be feeble, even at its brightest, the amount of light admitted at any time might not be sufficient to injure the eye, though the pupil should remain dilated. But, as a general rule, contraction is necessary when there is an increase of brightness, and the automatic instinct acts according to this rule, making no exception for particular cases. No doubt the rods and cones of the retina have their share in the discomfort, and are in their own manner continually trying and failing to adjust themselves to the change of circumstances.

In speaking of the æsthetic use of black, Mr. Allen remarks, "In short, the real pleasure in every instance is derived from the positive light, and the blackness only acts as a repairer or non-stimulant." Why, then, does not the positive light produce the disagreeable sensation of a flicker? On our own hypothesis we can answer that when the light occurs in large masses there is generally a sensible *gradation* from light to dark; when it occurs in small bright points, the brightness and darkness are perceived *simultaneously*, not *successively*. If, however, the points be too near together, so that the eye ranges from one to the other, the effect is bad. A black dress, thickly sprinkled with well-defined white spots, is almost unbearably dazzling.

(To be continued.)

A "Beginners' Star Atlas," by the Rev. I. E. Espin, with an introduction by Mr. J. A. Westwood Oliver, is in the press, and will be published shortly by Messrs. Sonnenschein & Co.

MIGRATION OF BLOWING VIPERS.

By C. Few Seiss.

A FEW seasons ago, a narrow sandy island on the coast of New Jersey was overrun with countless numbers of the common toad (*Bufo lentiginosus Americanus*). The toad is generally of crepuscular habits, except during cloudy and rainy weather, but here they were met with, out in search of food, at all hours of the day, even beneath the hot glare of the noonday sun. It may be that, had they all waited until the cool of the evening to hunt for their insect prey, many of the weaker and less active toads would have been supperless. So, by hunting both by day and night, they were able to secure both diurnal and nocturnal insects. Over two hundred toads were counted in a short stroll between four and five o'clock in the afternoon of a July day. At this period there were no snakes of any kind to be met with on the island. That a few did exist I do not doubt, but they were not observed.

Now, this narrow island is separated from the mainland by a small bay, or thoroughfare, which is, perhaps, over a quarter of a mile wide at its narrowest portion. The vegetation on the island consisted of little else than rank grass, stunted cedars, and pines.

In the season following the one above noted, the toads were again innumerable, but, what was startling, "blowing vipers" (*Heterodon platyrhinus*) were numerous also. They were observed in nearly every part of the island, and were seen pursuing, capturing, and swallowing the toads, as though bent on their extermination. Sometimes a toad would endeavour to escape by quickly burrowing into the sand, but the snake, having marked the spot where the toad disappeared, would force its head, with shovel-like snout, into the sand, seize the unfortunate toad, drag it from its hiding-place, and swallow it (see illustration).

What was the cause of this sudden appearance and number of snakes? They made their appearance in early summer, when the young *Heterodons* were not yet out of the egg, and it requires several months of growth before they are capable of mastering an average-sized toad. Did

they come from the mainland by swimming across the bay, which at its narrowest part is a quarter of a mile wide? This would seem like a great undertaking for a non-aquatic species, but, nevertheless, it is the only way in which they could have come. A migration of snakes has never before come under my notice, and yet I must consider this sudden appearance of "blowing vipers" as such. It is highly probable that food became scarce in their old haunts, and they migrated to the island in hopes of finding food more plentiful. It is not probable that their sense of smell is so highly developed as to have scented the toads from such a distance, and that they were quitting their old home with the certain knowledge that food in abundance awaited them on this sandy island.

In the summer following this migration, toads were not numerous, and only a few snakes were observed; and such, I learn, has been the case for the two or three intervening years since then. Of course, great numbers of the snakes were killed by man; not because they were thought to be poisonous, for this species is here generally and correctly understood to be perfectly harmless, nor always for mere wantonness, but from the belief that in destroying the snakes they were preserving the lives of many toads, which were beneficial to man, inasmuch as they fed upon mosquitoes. Now, the tormenting mosquito (*Culex damnosus*) is by far too small a species of game for the toad. I have examined the contents of the stomachs of several maritime toads, but failed to find mosquitoes. Very young toads, which have just left the water and the tadpole stage, do feed upon minute insects, such as gnats, ants, aphides, &c., but I refer only to the mature animals.—*Scientific American.*

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

(*Continued from p.* 324.)

THE SIXTH EVENING.

NEW OBSERVATIONS CONFIRMING THE PRECEDING ONES, AND SOME FURTHER DISCOVERIES MADE IN THE HEAVENS.

'TIS so long since the Marchioness and I had any discourse concerning the planetary worlds, that we began to question whether we had ever talked on that subject. I went one day to visit her, and came in just as two very polite gentlemen had taken their leaves of her.

"Well!" says Madam, the very moment she perceived me, "you see what visiters I have had; and I protest it has given me some room to suspect it has been in your power to impose upon my judgment."

"I should be very proud," reply'd I, "if I could flatter myself with such a power, because I look upon it to be the hardest task any one could attempt."

"As hard as it is," says she, "I am afraid you have done it. I know not how it came about, but our conversation turned upon the plurality of worlds with my two friends who are just gone: I am not certain, but they might introduce the discourse with a malicious design. I made no scruple to tell them directly, that all the planets were inhabited; one of them reply'd, he was very well satisfy'd I did not believe a word of it; and I, with all the simplicity imaginable, maintain'd it was my real opinion; he still look'd upon it as a piece of dissimulation, design'd to divert the company; and I thought what made him so positive that I did not believe my own sentiments was, that he had too high an opinion of me to conceive that I could entertain so extravagant a notion. As for the other gentleman, who had not altogether that esteem for me, he took me at my word. For God's sake, why did you put a thing in my head which people that value me cannot think I maintain seriously?"

"Nay, madam," says I; "but why would you attempt to maintain any serious position among a set of people who, I am sure, never entered into a way of reasoning which had the least cast of seriousness. We should not affront the inhabitants of the planets so highly; but content ourselves with being a little select number of advocates for them, and not communicate our mysteries to the vulgar."

"How," says the Marchioness, "do you call my two last visitants the vulgar?"

"They may have wit enough," says I, "but they never reason at all. And your reasoners, who are a severe set of people, will not make any difficulty of sorting them with the vulgar. On the other hand, these men of fire revenge themselves by ridiculing the reasoners; and think it is a very just principle in nature that every species despises what it wants. It were right, if it was possible, to conform ourselves to every species; and it had been much better for you to have rallied on the inhabitants of the planets with your two friends, because they are better at raillery than reasoning, which they never make use of. You had then come off with their joint esteem; and the planets had not lost a single inhabitant by it."

"Would you have had me," says she, "sacrifice the truth to a jest? And is that all the conscience you have?"

"I own," answered I, "that I have no great zeal for these kind of truths, and I will sacrifice them with all my soul to the least conveniences of company. For instance, I see what is, and always will be, the reason why the opinion of the planets being inhabited is not thought so probable as it really is. The planets always present themselves to our view as bodies which emit light; and not at all like great plains and meadows. We should readily agree that plains and meadows were inhabited; but for luminous bodies to be so too, there is no ground to believe. Reason may come and tell us, over and over, that there are plains and meadows in these planets; but reason comes a day too late. One glance of our eyes has had its effect before her; we will not hear a word she says; the planets must be luminous bodies, and what sort of inhabitants they should have, our imagination, of course, would presently represent their figures to us. It is what she cannot do, and the shortest way is to believe there are no such beings. Would you have me, for the establishment of these planetary people, whose interests are far from touching me, go to attack those formidable powers called Sense and Imagination? It is an enterprise would require a good stock of courage, and we cannot easily prevail on men to substitute their reason in the place of their eyes. I sometimes meet with reasonable people, who are willing, after a thousand demonstrations, to believe that the planets are so many earths; but their belief is not such as it would be if they had not seen them under a different appearance. They still remember the first idea they entertained, and cannot well recover themselves from it. It is these kind of people who, in believing our opinion, seem to do it a courtesy, and only favour it for the sake of a certain pleasure which its singularity gives them."

"Well, says the Marchioness, interrupting me, "and is not this sufficient for an opinion, which is but barely probable?"

"You would be very much surprized," says I, "if I should tell you probable is not a very modest term. Is it simply probable that there ever was such a man as Alexander the Great? You hold it very certain that there was, and upon what is this certainty founded? Because you have all the proofs which you could desire in a like matter, and there does not the least subject for doubt present itself, to suspend or arrest your determination? For you never could see this Alexander, and you have not one mathematical demonstration that there ever was such a man. Now, what would you say if the inhabitants of the planets were almost in the very same case? We cannot pretend to make you see them, and you cannot insist upon the demonstration here as you would in a mathematical question. But you have all the proofs you could desire in our world."

(To be continued.)

THE AMATEUR PHOTOGRAPHIC EXHIBITION.

PHOTOGRAPHY, which during the first years of its existence was limited to the practice of a few experts and a large number of professionals of more or less doubtful skill, has, owing to the modern invention of dry plates, become no longer a "black art," fraught with dirt and dangers to hands and clothes, and beset with difficulties, but an art of comparatively easy acquirement and pleasant practice. Hence the evolution of that recent production, the amateur photographer, a species that has increased to such an enormous extent in a short time that it can no longer be regarded as phenomenal, except by its rapid development. We have now amateur photographers of both sexes and all ages, and the population has grown so large that it is able to support its own newspaper. One of the influences which has been most active in producing this happy state of affairs is that of the London Stereoscopic and Photographic Company, who, some time ago, threw open its doors to the general public, arranged comfortable studios, and provided competent masters for the instruction of all comers. So many have availed themselves of this instruction, that a suggestion was made to hold an exhibition of the students' work. The company, however, improved upon this suggestion, and determined to hold an exhibition on a large scale, to which all amateurs should be invited to contribute. The invitation was so warmly responded to that about 1,500 frames, most of them containing several pictures, were sent in, with the result that on April 23, the largest exhibition of photographs which has ever been held was opened at 103, New Bond-street (Mr. Gullick's Galleries). The Exhibition, which will remain open until the 9th inst., is a thorough success in every respect, and will, we hope, encourage its promoters to make it an annual affair.

The exhibits are divided into thirteen classes, in each of which valuable prizes are given by the Company, and in some cases also by outsiders, as we shall point out hereafter.

Class I. is open to pupils of the London Stereoscopic and Photographic Company, and the Silver Medal in this class is awarded to a lady, Mrs. Harrison, No. 1B, for a group of photographs called "The Lawyer's Home, Crief, N.B.;" especially notable is her picture of a drawing-room interior; the bronze medals to Messrs. Sidney Platt, No. 19, A. Turnham, 6A, and A. Batchelor, 7A. Class I. is particularly interesting, as to a great extent the work shown is that of beginners, and it clearly illustrates the progress which may be made in a very short time by those endowed with artistic taste, together with a little perseverance. Among several very attractive exhibits in this class is a necessarily instantaneous photograph of a flash of lightning, which is probably the best of its kind that has ever been taken, and can easily be appreciated by those who know the extreme difficulties of the subject. The lightning is seen playing through the rigging of H.M.S. *Neptune*, from the deck of which it was taken by Mr. Francis R. M. Puddicombe, Surgeon R.N., on the night of November 14 last, during heavy rain, when the ship was between Madeira and Gibraltar. A melancholy interest is attached to No. 20, "Nine Views in the Soudan," taken by the late Mr. Cameron, war correspondent of the *Standard*, who met a gallant death before Metemmeh. Mr. Cameron was a pupil of Mr. Humphreys, at the Stereoscopic Company, and his negatives were sent to them, by whom they were printed. These photographs are unfortunately somewhat wanting in clearness, owing to their having been exposed in the too bright light of the Eastern sun. No. 13 is a charming portrait of an old lady, by Mr. W. B. Roger. The photographs of a tour in Spain (18), by Mr. Tomlinson, well deserve the high commendation they have received.

Class II. Marine Pictures. A silver medal is awarded to Mr. P. H. Emerson, for his series, "A Misty Morning," &c., No. 2. These photographs are exquisitely done in Platinotype, and look like very fine engravings. Another silver medal has been well won by Mr. W. Gaddum for his series, "Genoa Harbour," &c. (27). The bronze medals were awarded to Mr. Matthew Whiting for No. 4, Mr. W. C. Williams, No. 19, beautiful instantaneous effects, and to Mr. R. Leventhorpe, No. 1. Noticeable exhibits in this group are Mr. H. Vanner's "Regatta Day, Lowestoft" (32), the crowd and donkeys in which come out with great effect, and Mr. F. Briglman's "By Moonlight on the Sea" (39), a perfect little gem.

Class III. The country-house group. The gold medal is awarded to Mr. J. R. Brindson for his excellent pictures Nos. 28–42; the silver medal to Mr. J. Taylor for his "Mare and Foal" (49). No. 10, "Some old Friends at the Zoo," by C. Hinxman, is a most attractive series containing the white bear, an elephant with its keeper, surmounted by a cargo of boys, a zebra with its keeper, and a beautiful group of storks round a pool. The photographs are most artistically grouped, and are extremely creditable, considering the difficulties under which they must have been taken, for, next to babies, animals are the most troublesome things to get fixed that can possibly be imagined. The only fault we detect in them is that they are perhaps printed a little too dark. This exhibit obtained a bronze medal. Mr. A. Mathison's "Fisher Lassies," No. 85, is a charming group, well deserving the bronze medal awarded to it.

Class IV. The Coventry Machinists' Company's prize, one of their best tricycles, has been awarded to Mr. E. Brightman for a fine series, Nos. 38—43; a set of photographic apparatus to Mr. W. S. Anderson (15); and bronze medals to Messrs. T. M. Brownrigg (19) and T. Huson (32). This class, which was open to all cyclists, will doubtless prove of great interest to riders of the iron steed.

Class V. Army and Navy prize.—The gold medal for the best general work has been awarded to Major-General Sir Charles Keys, who also obtained a bronze medal in Class III. for his "Cricket Match" (27). This gentleman shows numerous exhibits in various classes, and all his work is done in a most masterly manner; especially notable are his "Moorish Heads" in Class IX. Major Stewart has been awarded a bronze medal for the general excellence of his work.

Class VI. The gold medal for the best photograph taken on an X. L. Edwards' gelatine plate was awarded to Mr. S. Norman (28) for some good landscape studies, while Mr. A. Millar (7A) obtained a bronze medal.

Class VII. The gold medal for the best platinotype picture has fallen to Mr. Earnest A. Gould, for No. 12A.

Class VIII. Open to ladies only. This class contains some very excellent exhibits, and, as a whole, speaks well for the perseverance and artistic skill of the fair sex. The silver medal was awarded to the Misses Lindsay Antrobus, for a series of beautiful views, and bronze medals to Miss Holford, and Miss Maud C. Kitchin, for her clever "studies of dogs" (24).

Class IX is the largest class, being open to all amateurs. In it two gold medals were awarded, one to the Rev. H. B. Hare for No. 122, "The Old Mill Weir," and "The Meeting of the Waters," which obtained the silver medal given by the *Amateur Photographer* for the most artistic photographs; the other to Mr. Henry Stevens, for No. 309, "Six Studies of Flowers." Mr. Stevens shows several other exhibits of flower studies, which are all exquisitely graceful and artistic; he has also won a bronze medal in Class XII., for his beautiful transparency, "Roses and Dewdrops" (12). Silver medals for architectural subjects were awarded to Mr. A. Pringle for his "Moorish Architecture" (67), a noteworthy exhibit, and to Messrs. G. Bankart, T. N. Armstrong, and A. A. Berens. Bronze medals to Lord Walter Campbell, for Nos. 47–50, charming studies of Mrs. Finney and of his own children; Messrs. A. W. Beer, A. Mathison, A. C. Bicknell, W. L. Colls, R. B. White, C. P. and D. Downing, and C. E. Abney.

Class X. Open to all amateurs. The silver medal for the best winter scene was awarded to Mr. R. Leventhorpe for No. 5, "Winter at Papworth Everard, Cambs." The exhibits in this class are of exceptional beauty, winter landscapes being rather uncommon in photography.

Class XI. Open only to those who have begun to practise photography in the year 1885, contains many exhibits which do credit to the beginners in the art. The silver medal is awarded to Mr. H. Champion for a group of portraits (No. 1.)

Class XII. Transparencies on glass. Silver medal awarded to Mr. Murray for No. 15, "Three Rustic Views, and Breakers." Bronze medals to Mr. F. Briglman for twelve clever lantern-slides (6), and Messrs. H. Stevens and G. Manfield. A notable exhibit is No. 11, "Reading the News," also by Mr. Stevens.

Class XIII. Enlargements. Silver medal awarded to Lieutenant-Colonel Sandeman for No. 17. Most of the enlargements are done from quarter-plate cameras.

It is impossible, in the limited space at our command, to do more than mention a few of the most notable exhibits, nor is it desirable to do so, for descriptions of pictures are of no great interest to those who have not seen them, while to those who have, they are unnecessary. Viewing the exhibition as a whole, it is in the highest degree satisfactory, and speaks volumes as to the progress of an art which is equally useful and ornamental.

ERRATA.—In Dr. Hutchinson's paper on "Termites," at p. 104, line 11, for "formation" read "foundation"; line 36, for "extending" read "extruding"; line 41, for "photiphobia" read "photophobia"; line 55, for "open moonlight" read "open, overnight." At p. 142, line 6 from bottom, for "secret" read "scent."——In the paragraph announcing Miss Ada Ballin's forthcoming work, with which the second column on p. 357 commences, "Darmertcher" is printed for Darmesteter.

THE INTERNATIONAL INVENTIONS EXHIBITION.

THIS Exhibition, which, if no disaster intervenes, will be opened on Monday next with all the *éclat* that an immense gathering of those of the public interested in the venture, coupled with a goodly assemblage of notabilities, can bestow, bodes well to prove itself one of the most interesting and, above all, the most useful collections of the fruits of the world's industry that has been brought together for many years, even if in some respects it does not surpass the glories of 1851. It was apparent, on the first announcement of the purpose of this year's show, that the field available was of sufficient immensity to warrant the anticipation of a great success. And such a success is already assured. Doubtless many of the surroundings of the two preceding shows — the Fisheries and the Health Exhibition—which it is expected will be repeated, and possibly in even a better form than heretofore, lend considerably to the presumption of something good in the coming display; but apart from all those attractions, there is the fact, asseverated by many of those on the spot, and therefore best able to judge, that the Inventions Exhibition will comprise the most extensive display of good things that has ever been brought together. And there is every reason to expect that this should be so. It is safe to assume that there is no branch of industry, no branch of human labour, which can fairly be excluded, if we are to judge from the title of the Exhibition. What a vast, an unmeasurable field, then, opens itself before us as we try to conceive the possible limits of the collection. As a matter of fact, no one mind can accomplish such a task, and it is well that the Executive is one which may be characterised for its heterogeneity. Beyond the fact that no article which has been exhibited in either of the two preceding exhibitions is to be admitted, it is impossible to imagine a single application of human ingenuity which should not find a place in the Exhibition of 1885. It is fortunate for the hundreds of thousands, or probably millions, of visitors that this is so. There cannot fail to be much that will interest every one who is desirous of learning something, great or small, and he will doubtless be able to start on his journey thitherwards without being assailed by the presentiment that he is to feast (or deaden) his eyes simply upon a series of well-dressed shop-fronts. Jam-pots, in their way, have a place in the world, and perhaps might, by a broad expansion of the term, be regarded as inventions, albeit somewhat ancient, but they should have no place in the new Exhibition; and as they and other equally useful (or useless) exhibits held an unduly prominent position last year, there is little fear of their troubling us during the coming summer.

Perambulations through the various sections of the Exhibition-buildings convince us that the new Exhibition will be all that we could desire, and that no effort will be spared to impart to it a degree of utility, interest, and profit not previously attained. Utility, in that every one will be able to see something capable of being rendered subservient to his requirements; interest, in that no one will be able to leave without having seen something attractive; profitable, in that every one will depart wiser than he came; and, further, that the exhibitors of such appliances or commodities as appeal to the sightseers must realise something in the way of business. Upon these three grounds it is that we shall take our stand in reviewing, week by week, the wares displayed in the various departments of the Exhibition.

Although we have spoken thus favourably of the Exhi-

bition and its prospects, it must not be supposed that already the various groups and classes are arranged, and that all is in readiness and waiting for the opening ceremony. Nothing of the kind. It would, indeed, be an unique Exhibition were such the case. Even now one may walk through rows and channels of untouched packing-cases, while here and there is a space to be seen which evidently was intended for something or other, but which has not yet put in an appearance. This always happens. Why, in the name of reason, it should be so, no one can imagine, unless it be that everybody is anxious to wait until the last moment to ascertain what sort of a show everybody else can bring together. Nevertheless great—indeed, rapid and unmistakable progress is being made. One has only to absent himself for a day to have impressed upon him how much can be done in the space of a few hours. As the coming Monday draws gradually near, so, no doubt, will ever-increasing exertion be made by all concerned to have everything, or as nearly so as possible, ready for the inauguration. Those who do not take time by the forelock will find next week that the influx of visitors will be too great to permit of much being done then that ought to be done this week. It is to be hoped that the sluggards will be few, and that there will be no occasion for one to put off his visit till a more fitting opportunity—that is, till matters are in a more forward condition. Rather let it be that the visitor of the opening week will be as much rewarded as any other.

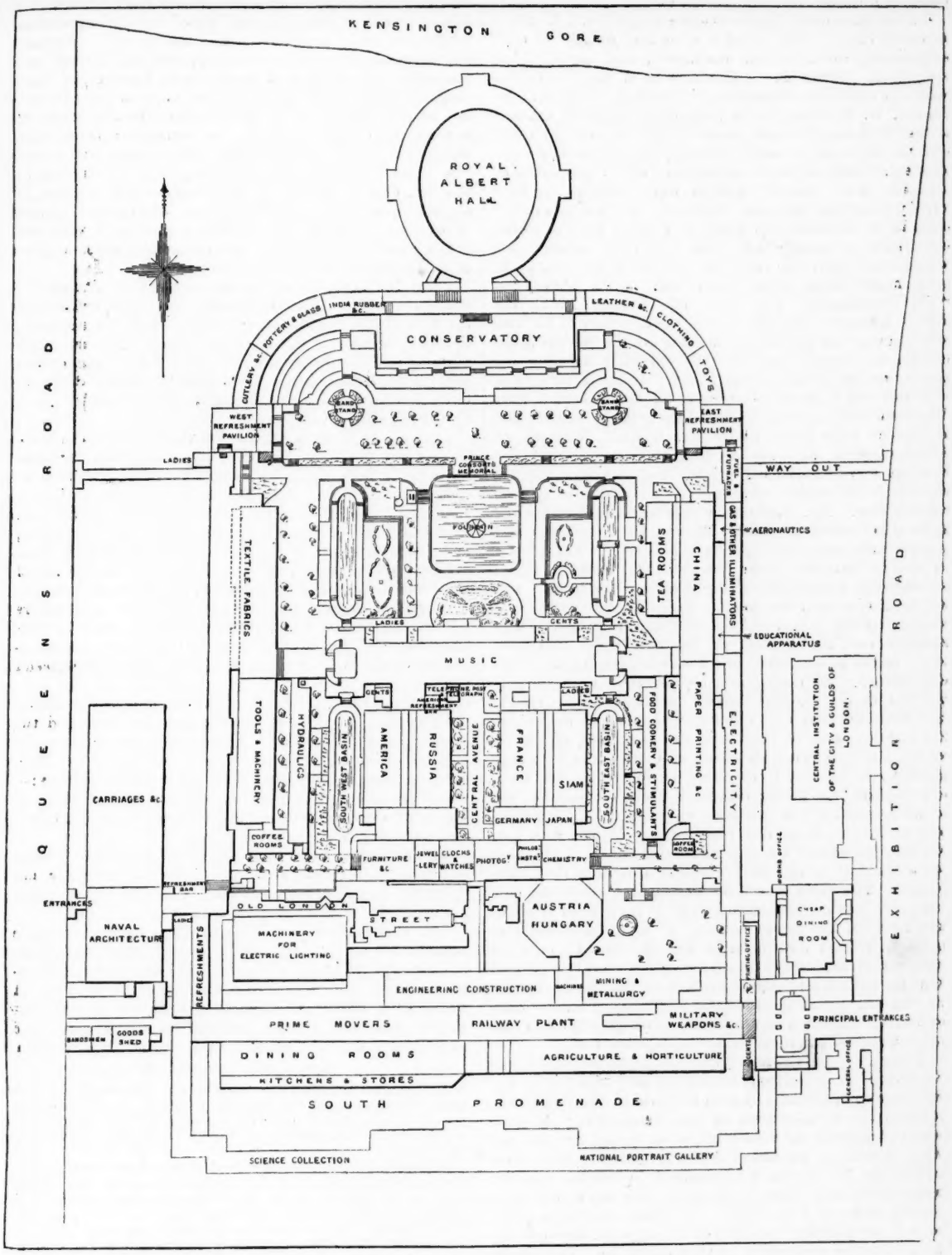
For the convenience of those of our readers who purpose visiting the Exhibition we give this week a plan of the building, together with a general survey of the various branches of industry and knowledge represented therein. To those acquainted with the building and its neighbourhood little need be said. For the benefit, however, of those not so acquainted, it may be mentioned that there are two entrances, one in Exhibition-road, and the other in Queen's-gate. There is a special significance in mentioning this fact, seeing that last year the former entrance was often beseiged, while the other had but few patrons. The Exhibition-road entrance is close to the South Kensington station, on the Underground Railway, where the officials were daily in a state of intense worry and anxiety consequent on the multitudes of passengers passing their barriers. A deal of the crushing and its concomitant evils was avoidable, seeing that the Queen's-gate entrance is close to the Gloucester-road station, on the same companies' systems, and yet was relatively only very slightly patronised. Increased facilities are, however, being prepared at the South Kensington station, which should materially reduce the pressure on the station staircases. A subway is being constructed under the road from the station to the entrance to the Exhibition. It is being lined with white glazed bricks, and a number of openings in the road will be provided, through which air and light will be able to find access to the tunnel. In wet weather this subway will prove an exceptional boon, although there is little doubt but that the rush for the South Kensington station will be greater than ever.

So far as the grounds are concerned, the general arrangement will be much the same as heretofore. The fountain, which under the care of Colonel Sir Francis Bolton evoked such universal admiration from the assembled throngs last year, will, under the same careful guidance, again prove very attractive. It is to be illuminated by Messrs. Siemens Bros., and will be worked from the same basin as last year, in a position whence it may be viewed by the greatest number of spectators assembled on the extensive terraces which almost surround it. The band-stands occupy their old position, and will be largely used.

Concerning the Exhibition itself, it must not be forgotten that music is to occupy a large share; in fact, the title of the Exhibition ought rather to be Inventions and Music, instead of simply Inventions. The Exhibition is divided into two divisions, of which the first is styled Inventions and the second Music. The first division has allotted to it the whole of the outer buildings and a portion of the inner ones, while the second division absorbs the major portion of the central buildings. This will be better seen as we proceed to discuss the general features of the various sections. The Exhibition is to be again illuminated by means of electricity, and the grounds, which last year were decorated with Chinese lanterns and other similar devices, are this year to be made dependent upon the same source of light as the buildings themselves. The lighting, however, is so important a branch of the subject that it will be necessary to deal with it separately. Suffice it here to say that the collection of electric lighting plant will be the largest and most comprehensive ever brought together. The interior of the building is to be lighted every evening by nearly 500 arc lamps, and over 5,500 incandescent lamps; while the grounds, terraces, and the outlines of the buildings will be illuminated by about 20,000 incandescent lamps instantaneously lighted.

It is noteworthy that the exhibitors' space has been very materially increased since last year, and that without encroaching upon the grounds to which general access was obtainable.

A brief summary of what is being or will be done in the various parts of the exhibition may prove of service. The visitor, on passing the turnstile at the Exhibition-road entrance, approaches a series of courts known as the South Galleries. These are devoted to the heavier departments of mechanical industry and to munitions of war. In the central court will be the exhibits of the Admiralty and War Office, including a series of torpedoes and similar tackle, and machine-guns by Nordenfelt, Hotchkiss, and Maxim. The latter inventor will work one of his guns in the grounds outside the galleries, near what is called the Queen's-gate Annexe, and will doubtless interest large numbers of visitors, more particularly at the present juncture, when wars and rumours of wars fill the air around us. The War Office will also exhibit one of the latest patterns of 13-ton guns with a bore of 5 in. If this section proves an advance upon the War Office exhibit at the Crystal Palace during the Electric Exhibition of 1881-2, it will be sure to prove highly instructive, and will reflect credit upon those who have assigned it so prominent a position. In the same court will be seen a fine collection of railway plant, including several specimens of locomotives, from the London and North-Western Railway Company's large Webb compound locomotive down to the smallest in the kingdom. Railway signals, in the face of recent accidents, will prove an interesting section of the exhibition, and a plentiful show of this class of apparatus is promised by the best makers. The Westinghouse brake will come in for a share of attention, and couplings, brakes, and many of the other important features of railway work will be prominently displayed. Besides railway engines, this section will embrace a number of other forms of prime motors, including engines by Hornsby & Sons, J. and E. Wood, Walker Bros., and other eminent firms. To enhance the practical value of this section of the exhibition, three short railways will be fitted up and worked. One will be an overhead railway, worked upon Rammel's patent compressed air system. The other two lines will be constructed in the grounds outside, one being an electric railway by Mr. Holroyd Smith, who is already well known in this field of labour; the other will be worked by the



PLAN OF THE INTERNATIONAL INVENTIONS EXHIBITION, 1885.

British McKarski Air-Engine Co. The length of these out-door lines will be about 700 ft. each.

In the court on the right—known as the North Court—is being rapidly put together a capital display of civil engineering work, mining machinery, and metallurgical appliances. Noticable in this section of the Exhibition will be a collection of mechanical "testing" apparatus, by Messrs. W. H. Bailey & Co.; but there is already finished a case of metal specimens, than which it is doubtful if any other exhibit may be seen involving discoveries of greater moment. This exhibit is illustrative of the properties of Bessemer steel. Several samples which have undergone a variety of crucial tests are displayed. At the side of the case, in an unpretentious place, is a small piece of metal, comprising apparently less than two cubic inches, but which may fairly be said to be worth its weight in gold many times over. And this is its history:—"On Wednesday, the 13th of August, 1856, Sir Henry Bessemer first announced the discovery of his now well-known steel process at a meeting of the British Association at Cheltenham. On the following morning his paper was published in the *Times*. In the afternoon of that day the account was read at the great Dowlais Iron Works in Wales, where it excited the greatest interest, and it was at once perceived by Mr. Edward Williams, of Middlesbrough, who was at that time manager of the bar-iron department at Dowlais, that the new process threatened an entire revolution in the system of making railway bars. Mr. Williams at once determined to put the process to the test of experiment, and with an energy and perseverance rarely equalled, he and his staff of workpeople, in conjunction with their chemist, Mr. Edward Riley, succeeded in extemporising a "Bessemer Converter," and by the afternoon of Saturday a charge of pig-iron was converted and run into troughs of sand on the ground. These rudely-formed ingots were on Saturday rolled into bars, much to the astonishment of all who had taken part in the experiments. So deeply and so favourably were the proprietors of the Dowlais Works impressed by the results thus obtained, that they came up to London on the following Tuesday, and on that same day purchased of the inventor a licence to use his patent at their works for a cash payment of £10,000, returning to Wales on the same evening, or just within one week from the date of the announcement of the invention at Cheltenham, thus backing their faith in the new process solely on this first bar, the small portion of which is here exhibited." If anything were wanting to stimulate would-be inventors they have it here. The world is not yet so full of comfort and contentment, nor has human ingenuity so far availed itself of the forces of Nature, as to leave no hope for further progress. Progress there must be, and the man that realises this, and makes a move forward may nowadays rest assured that he will get a substantial return for his labours, besides having such pleasure as is to be derived from a knowledge of having conferred a real boon, often greater than the boldest general can hope for, upon his fellow men.

The gallery on the left, known as the South Court, will be devoted to agricultural machinery, and here plenty will be found from abroad and from all parts of the kingdom to interest the rural portion of the community. In these times of agricultural depression, when the tiller of the soil finds it next to an impossibility to earn his bread as a reward for his labours, it behoves him to turn his attention to the products of inventive genius. One can scarcely help feeling, however, that there is too great a degree of gaudiness in the painting, and that on that account the machines look hardly so serviceable as they might do. This applies as much to English as to American productions.

Returning to the main entrance, the visitor will find on his left hand a long gallery known as the East Arcade. In this place will be found the exhibits of electrical apparatus, which are being brought together fairly well. Further on, the gas appliances are exhibited, and still further fuel (including a good show of gas-stoves by Fletcher, of Warrington), educational apparatus, and aëronautics. On the left of this gallery is the East Gallery, part of which is devoted to Chinese exhibits, the remainder being very well stocked with machines for paper-making and printing. The East Annexe is another gallery still further to the left, and is allotted to the Food section. Here, if anywhere, we shall find displays void of any real interest or utility. Already may be seen a number of tubs and boxes labelled "Butterine," and presumably other articles of a like nature will find their way here.

From the northern extremity of the East Arcade the visitor enters the "East Quadrant," in which are located the toys, clothing, and leather groups. Very little appears to be in readiness in either of the classes. Nor can much more be said for the indiarubber, pottery and glass, or cutlery groups, which occupy the "West Quadrant," although there is some promise of a first-rate show of rubber goods by the Silvertown Company.

Leaving the West Quadrant, the visitor enters the West Gallery and the West Arcade, where considerable progress has already been made, and where much will be seen of considerable interest. John Bell & Co, of London; Watson, Laidlow, & Co., of Glasgow; Farmer & Sons, of Salford; Mather & Platt, of Manchester; Halse & Co., of Manchester, and a number of others promise excellent displays in their different specialties. The West Annexe is on the left of the West Gallery, and is devoted to hydraulic machinery.

Carriages, bicycles, and tricycles, and naval architecture will together make an attractive display in the "Queen's Gate Annexe," which is to the right (when walking southwards) of the West Arcade, and into which the Queen's Gate entrance opens.

The South Central Gallery runs from east to west across the grounds, just north of the Old London Street and the Austro-Hungarian section. Here a collection is being put together which ought to constitute an exhibition in itself, exhibits being requisitioned from the following classes:—Chemistry and physics, philosophical instruments (many of the best makers are well to the front), photography, clocks and watches, jewellery, and furniture.

The extensive galleries to the north, allotted to foreign countries, as marked on the plan, are unfortunately but sparingly occupied, although large consignments of goods are streaming in and being put into position.

The second division of the exhibition devoted to music occupies the whole of the central gallery, which looks very much as though it will have hard work to contain comfortably all the good things that are being placed in it. A really good display of musical instruments by the best known firms will be made, and the central gallery should prove one of the most attractive portions of the exhibition.

A Novelties Exhibition is to be held in Philadelphia this year under the auspices of the Franklin Institute. It will open on Tuesday, Sept. 15, and close on Oct. 31. The exhibits are to be restricted to such as possess the double qualification of "novelty and merit."

A Textile Shield.—The Mexican Indians, when at warfare with troops, make a shield out of their blankets by wetting and holding them up by the upper edges. Bullets sway the blankets instead of penetrating them, the blanket acting like a ballistic pendulum. These blankets are hand-woven, and are fulled until thick and waterproof. The object in wetting them may be to facilitate the glancing of bullets which strike the blankets at acute angles.—*Engineering*.

CHAPTERS ON MODERN DOMESTIC ECONOMY.

XXV.—THE FRAMEWORK OF THE DWELLING-HOUSE.

STRUCTURAL EXAMPLES (*continued*).

THE DISPOSAL OF HOUSEHOLD REFUSE.

OF the numerous methods which have hitherto been employed to ventilate the house-drains and soil-pipes of the better class of tenements, it must be admitted that the plan now being introduced by Messrs. Wm. Hill & Sons, of Manchester, and noticed in our last chapter as the "Patent Extractor" ventilator, leaves scarcely any room for improvement. Fig. 24 shows the way in which this form of ventilator can be adapted to a soil-pipe, so as to continuously extract and consume all the sewer-gases which may, and are very liable to, collect within the household drains. It relieves the pressure from the closet apparatus, and discharges purified air only from its outlet, so that there cannot possibly be any danger of entry of unwholesome gases into the house by way of windows adjacent to the ventilating head, or in a line with the direction of prevailing winds therefrom.

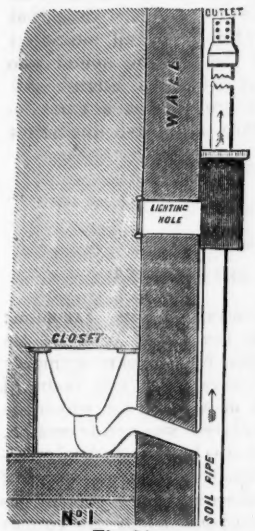


Fig. 24.

We shall now pass on to an explanation of the details of closet furniture as such, but, in order to avoid undue repetition, we must refer our readers to our former remarks upon the principles of this subject, and confine our attention to but a very few types out of the hundreds of examples that are to be found in the market.

The greater proportion of houses within the metropolitan area are provided with what is known as the "Pan Closet," and D-trap. We would here make an urgent appeal to those of our readers who live in London, to make a careful examination into the state of affairs in each of their houses, and, should they find the defective apparatus we are about to describe, to insist upon its immediate removal and the substitution of one of the many valuable contrivances of recent inventors.

The Pan Closet consists of a conical stoneware or china basin fixed into the top of a large receptacle, usually made of iron, and called the "container." The edge of the orifice of the basin, situated at the bottom, or position of the conical apex, dips into a metal bowl or "pan," generally made of tinned copper, which is capable of being moved inwards and downwards within the container, when the pull-up handle is made use of, and which, after splashing its contents into the container, swings back to form a pan at the bottom of the basin for holding a quantity of water, the last that has been used for flushing the basin with. The apparatus is thus provided with a water-seal between the basin and the container. The bottom of the container is provided with a 3-inch outlet-pipe which descends into a D-trap, so-called because in shape it resembles the letter D turned thus :—D. The trap is, as a rule, placed beneath the flooring, and into it may open the waste water from the bath, lavatory, housemaid's sinks, &c., whilst sometimes provision is made for the entry therein of water that may by accident get into the "safe" or leaden tray which protects the floor of the closet.

Now let us see how this complicated appliance fulfils its functions. The D-trap is of such a shape as to be peculiarly adapted to the collection of foul sediment from which unwholesome gases arise to fill the container; within the latter the products of decomposition are augmented, for it has been found that the sides of that metal receptacle, in time, become coated with an ever-increasing layer of filth. The result of all this is, that in the very house itself, special provision is made for a small cesspool in each closet, the gases from which enter the apartments every time that the pull-up handle is used. Not only that, the pipe which is intended to convey away the waste from the safe beneath the closet, is very seldom called into use, so that its real action is to afford a passage for sewer-gases from the D-trap into the safe, and hence into the room. The waste-pipes from the bath, lavatory, and sinks, moreover, become special ducts for the introduction of sewer-gases into the several departments to which they lead.

An attempt to cure the defect of pressure of foul gas within the container is worthy of note here, since it has been so universally employed, and with the most serious consequences. The container is generally provided with an aperture, from which a small pipe is conducted through the wall to the external atmosphere. This relieves the pressure within the receptacle, but does not remove the remaining foul gas. To ventilate the container and cause a current of fresh air to pass through it, two holes were then bored into its sides and ventilating pipes connected thereto. Experience has shown that these precautions almost always terminate in a cure which proves to be worse than the disease, for the ventilating holes are invariably left open, without any pipes being attached to them; hence the sewer gases are free to escape into the room continuously, and, when the pull-handle is employed, are forcibly driven out through these orifices, so violently, indeed, that the rush is sufficient to blow out the flame of a lighted candle placed near the aperture.

Another improvement has been to construct the entire apparatus out of stoneware. This certainly does away with the adherence of filth to the inside of the container to a large extent, especially if the surface is well glazed, as in the case of Doulton's "Lambeth Pan Closet."

The pan closet, then, wherever it may be found, ought to be condemned; but there are many persons who would be inclined to adopt a modification of the existing apparatus if it could be efficiently and less expensively carried out than an entirely new substitution. To this question Mr. Gregson Banner has devoted special attention, and has so far succeded in improving the ordinary pan closet that it can be used with comparative safety; his invention provides for the thorough facility with which every part of ths appliance can be inspected and cleaned, the total abolition of the D-trap, or, indeed, the absence of a trap of any kind, and an induced current of fresh air upwards through the soil-pipe. Although the pan closet can thus be remodelled to meet the demands of the sanitary inspector, its usual concomitant, the D-trap, ought never to find a place in any house, and when it is detected, should always be removed without delay. A simple pipe in its place, without any traps, will be found to be infinitely more valuable. It is most surprising to find that in spite of the prohibition of D-traps for new houses, the laws are not strict enough to prevent plumbers from inserting new traps of that form into the places of old ones that have succumbed to long usage, and that eminent firms of these wares still continue to manufacture them largely.

Editorial Gossip.

It is rarely indeed that I trouble myself in any way about the Royal Astronomical Society, but a circular has just reached me to which, I think, I may not unprofitably invite the especial attention of such Fellows of that Society as may read these lines. It is issued to convene a special meeting at 9 p.m. on Friday, May 8, on a requisition which has seemingly been sent in by eight of the Fellows, to consider the question of permitting absent Fellows to vote at the annual elections of the officers and Council on verification of their signature, and to vote, either personally or by proxy, on any business brought before annual or general special meetings. Also, incidentally, to discuss a suggested change of the hour of the ordinary evening meetings. Now it seems to me that every Fellow of the Society who is dissatisfied with the existing mode of election of the officers and Council of the Society, or who really wishes to exercise some influence, and make his opinions heard at meetings which he is, perforce, prevented from attending, should take especial care to be personally present next Friday night; as upon the aggregate of votes then recorded will depend whether for the future the members of the Council are to elect, as heretofore they practically have elected, themselves. A correspondent of a contemporary has called attention to the recurrence, year after year, of the same names on the Council-list, and of the wholly unworthy juggle by which the spirit of the 6th bye-law is annually systematically evaded. This, however, is not to be rectified by *writing* on the subject; but, as I have said above, by actual personal attendance and voting at the meeting. The inconvenience of remaining in London for a single night may enable many a country Fellow hereafter to exercise his due influence at Burlington House without quitting his own study in a remote part of the kingdom.

The pretty old custom referred to by Pepys in his "Diary" of women going forth into the fields to bathe their faces with May-dew, with the idea of making themselves beautiful, has unhappily died out. As a prescription, it was undoubtedly more efficacious than all the Kalydors and cosmetics ever invented.

Apropos of the first of May, it is curious to think that one of the huge permanent Maypoles which were erected in various parts of the metropolis and its immediate environs, was still standing close to Kennington-green ninety years ago, and that milkmaids used to dance round it.

The Liverpool Astronomical Society has just issued a capital number of its *Journal* for March. A paper by Dr. Hermann Klein (of "Hyginus N" celebrity) on "The True Nature of the Black Spots on the Moon," one on "Photographic Observations of the Great Nebula in Andromeda," and another on that rare phenomenon, "An Equatorial Sunspot," by the Rev. T. E. Espin, the President, and Miss E. Brown respectively, may be singled out rather for their comparative novelty amid a mass of equally interesting material.

Lord Onslow seems to be much exercised in his mind about cremation. The overwhelming proportion of people, who are ignorant of his very existence, will probably pay infinitely more deference to the opinions of such experts as Sir Lyon Playfair, Sir Spencer Wells, Sir Joseph Fayrer, and Dr. Cameron than they will to anything he may have to say on this subject. When it is proposed to burn the noble Earl himself, it will be ample time for him to protest.

Just as poor Lord Frederick Cavendish and Mr. Burke had to be immolated before any effective steps were taken to cope with the Dublin scum, so, I suppose, our own ineffable Home Secretary will be blown up ere effectual means are devised to stop the dynamite outrages in London, which are such a scandal and disgrace to our vaunted civilisation. The way is not far to seek. For every Gallagher in the conspiracy there are two Careys; in fact, if he could only receive assurance of his personal individual safety, there is scarcely a man among these gallant and courageous "patriots" who would not cheerfully sell his own father or brother to the authorities. An adequate system of espionage and a little judicious expenditure would soon stamp out this iniquity from our midst. But, of course, to watch or entrap a murderer *in posse* would be un-English; and it is so much better that the lives of a few score innocent men, women, and children should be sacrificed than that *that* reproach should be levelled at us! By all means let us give notice to the followers of the slinking hound who grovelled and shrieked for mercy before an English girl armed with a toy pistol! that we are playing a game according to rigid rules, of which they shall have due notice beforehand.

Reviews.

SOME BOOKS ON OUR TABLE.

Myths and Dreams. By Edward Clodd. (London: Chatto & Windus. 1885.)—In the empty pride of his heart, man has pictured his original progenitor as springing into life fully armed, like Minerva from the brain of Jupiter, the all but deified lord of a world for which the whole of the rest of the visible universe was and is created. Long fostered as this fond illusion was by ecclesiastical tradition, it is only in these latter days that the true history of man's advent upon earth and subsequent development has been made known, and his insignificance in the cosmos become apparent. Between the primitive savage ancestry of our race, however, and a Newton, a Shakespeare, a Milton, an Airy, a Tennyson, or a Thomson, how great and seemingly impassable a gulf is fixed; and hence the study of the steps by which this gulf has been bridged can scarcely fail to be of the most absorbing interest. How current ideas of the supernatural have had their origin in the myths and dreams of man in an early stage of his history, Mr. Clodd sets himself to tell in the work before us, which is an expansion and enlargement of a few essays on the same subject which originally appeared in Knowledge. To those who have read that portion of Mr. Clodd's volume here, his charm of style and closeness of reasoning will be already familiar, and they will possess themselves of his completed work in order to follow out his argument in its entirety. To all to whom this notice may serve to introduce the volume before us we can promise an intellectual treat of a high order in its perusal, and the acquisition of sounder views of man's actual place in nature and sources of belief in the supernatural than they possessed prior to reading it.

The Chemistry of Cookery. By W. Mattieu Williams. (London: Chatto & Windus. 1885.)—Here is another work, of which a portion has appeared in these columns, and which will be welcomed by all who wish to see the subject of the preparation of food reduced to a science. For no one will contend that anything worthy of the name of culinary science had any existence up to within a comparatively recent period. If here and there a man like Count Rumford did make an effort to formulate a theory of certain operations, his knowledge remained practically

locked up in his own breast; while a purely empirical art of cookery flourished merrily. And even now, with the land dotted with Board Schools, and young ladies of the labouring classes having the latitude and longitude of Seringapatam at their tongues' end, the number who can boil a cauliflower (to say nothing of frying a sole) properly is alarmingly small—a condition of things which must persist so long as cookery is performed by rule of thumb. Such of our readers as have seen that portion of the volume before us which appeared in these columns will recollect how perspicuously and pleasantly Mr. Mattieu Williams explains the why and the wherefore of each successive step in any given piece of culinary work: and the value of knowing why anything is done it would be hard to rate too highly. Every mistress of a household who wishes to raise her cook above the level of a mere automaton will purchase two copies of Mr. Williams's excellent book, the one for the kitchen and the other for her own careful and studious perusal.

The Moon and the Weather. By WALTER L. BROWNE. (London: Baillière, Tindall, & Cox.)—It used to be said that no waiter was ever engaged at (the now long defunct) Vauxhall Gardens, unless he could so carve a ham as to cover an acre of ground with the slices. Upon a cognate principle, Mr. Browne has spread over 120 pages what he might well have said within the compass of fifty. His style is diffuse to a degree, and his book practically void of any arrangement,—in fact, it is not until we arrive at p. 110 (!) that we get an inkling of what his hypothesis is. That he has confidence in it is evidenced by the fact that he gives predictions of the depressions and elevations of the barometer which (he says) will occur in the British Islands during April, May, and June of the present year. When the lady in the story read that a raven lived for a hundred years, she is reported to have said that she would buy one and see. Those interested in the matter should purchase Mr. Browne's predictions with a similar object.

Voice Use and Stimulants, by LENNOX BROWNE, F.R.C.S., ED. (London: Sampson Low, Marston, & Co., 1885.)—In the volume before us, Mr. Lennox Browne has collected a vast mass of statistics on the subjects of drinking and smoking, from no less than 380 professional vocalists, whose own replies to his questions he gives in a considerable number of cases. As the result of his investigations, he comes to the conclusion that a singer should be a teetotaler and a non-smoker. All vocal musicians, professional and amateur, who are content to do without any stimulants whatever, may find their justification for such action in Mr. Browne's book.

The Child's Voice, by EMIL BEHNKE and LENNOX BROWNE. (London: Sampson Low, Marston, & Co, 1885.)—This is a work which must address a considerably larger public than that which we have just noticed, and which contains really valuable information as to the training of the voices of boys and girls. As in the preparation of his "Voice Use and Stimulants," so, in the present volume, Mr. Browne seems to have appealed to a very extensive circle of professional vocalists for information; and their replies, of course, add both to the value and interest of his book. It may be accepted as a safe and trustworthy guide by all interested in the musical education of the young.

The Common Sense of the Exact Sciences. By the late WILLIAM KINGDON CLIFFORD. (London: Kegan Paul, Trench, & Co. 1885.)—The great brain which conceived and the hand which penned what forms the groundwork of the volume lying before us lie still and cold in the dust as, strangely enough, do those of the man who was originally selected to complete what Clifford left unfinished; but the master-mind is evident in the work, even in the comparatively fragmentary condition in which it was left when its author died, all too soon, at Madeira. In a preface signed "K. P." (which we believe we are justified in attributing to Professor Pearson), the last editor or co-author gives a succinct history of the whole work, and refers to his own share in it in terms which a perusal of his contributions shows to be quite needlessly apologetic. He has, if we may so speak, caught the true Cliffordian spirit, and much of his exposition is not unworthy of the master himself. Any one familiar only with the works on "Natural Philosophy" of twenty or thirty years ago, who will take up any recent work on physics, cannot fail to be struck with the revolution which has taken place in the treatment of the entire subject. It is as an introduction, if we may so speak, to the physics of to-day that "The Common Sense of the Exact Sciences" is intended to serve. Clifford's original intention, wisely abandoned, was to entitle his book "The First Principles of the Mathematical Sciences Explained to the Non-Mathematical," for certainly the book, as it stands, must go over the heads of those who do not possess a certain familiarity with algebra, geometry, and trigonometry. Not that such knowledge need be profound, but, at any rate, in an elementary form, it must exist. The book is divided into five chapters. I. and II. (on Number and Space), are substantially as Clifford left them. He was also responsible for half of Chapter III. (on Quantity), as he was for Chapter IV., (on Motion), as originally left, but which has been practically re-written by Professor Pearson, who is also the author of the latter half of Chapter III. and the whole of Chapter IV. (on Position). This last chapter, we may mention, is in parts a really admirable example of scientific exposition, which will suffer nothing in comparison with those preceding it. Every one who wishes to enter intelligently into the new world of physical science opened by those intellectual giants, Sir W. R. Hamilton, Clerk-Maxwell, Sir W. Thomson, and their compeers, should obtain this latest addition to "the International Scientific Series" without loss of time.

London in 1885. By HERBERT FRY. (London: W. H. Allen & Co.)—It would be difficult to find a book which better fulfils its avowed purpose than this most excellent compilation. Not only does it contain everything needed in a stranger's guide to every part of the metropolis, but it is so crammed with information as to be almost equally indispensable to the veriest Cockney who ever lifts his eyes from the pavement on which he is walking. As a guide-book, it seems as though it could hardly be improved upon.

Bell's Ladies' Reader. By DAVID CHARLES BELL. (London: Hodder & Stoughton. 1885.)—The art of reading aloud is far too much neglected in this country, and to such ladies as wish to acquire this delightful accomplishment Mr. Bell's course of instruction will be found very valuable. Commencing with the most minute directions for the management and use of the voice, pronunciation, accent, modulation, expression, &c., the author conducts his pupil, step by step, through poetry of increasing complexity and difficulty of recitation. The lady who has practised and mastered his instruction and its illustrative examples need have no fear of reading before the most critical audience.

Practical Guide to Photography. By MARION & Co. New Edition. (London: Marion & Co. 1885.)—The commendation which we bestowed upon the original edition of Messrs. Marion's book (Vol. V., p. 483) may be reiterated and emphasised in connection with the present larger and improved one. The most minute and detailed

instructions are given for every process, and illustrations appear of all the apparatus as employed. The difficulties which beset the beginner are lucidly cleared up; in fact, a day or two's practice, by the aid of this little volume, ought to make a passable photographer of a man who had never seen a camera before in his life.

The Asclepiad. By Benj. W. Richardson, M.D. (London: Longmans, Green & Co. April, 1885.)—Addressed primarily to the medical profession, it not unfrequently happens that Dr. Richardson's excellent journal contains matter of great interest to the layman. This is the case in the current number, in which a paper entitled "Researches on Resuscitation" possesses pecular importance in the face of certain recently reported American experiments in which it is asserted that dogs have been restored to life after *rigor mortis* had set in! The physiologist, too, will find himself repaid by the perusal of an essay on "Measures of Vital Tenacity."

The Child's Pictorial; a Monthly Coloured Magazine. No. I. (London: Society for Promoting Christian Knowledge.)—Here is a new candidate for juvenile favour which must infallibly become popular with the small folks. It is intended for children between four and eight, and, with its wealth of simple and amusing stories, and of coloured pictures to illustrate them, can hardly fail to become a great success.

We have also on our table:—*Compound Oxygen; its Mode of Action and Results; The Medico-Legal Journal, Proceedings of the Geological Society, Bradstreet's, Naturen, The Sanitary News, The British, Foreign, and Colonial Penny Postal Guide* (well worth the money), *The Kansas City Review, The Journal of the Society of Arts, The American Druggist, The Medical Press and Circular, The Tricyclist, Wheeling, The Country Brewer's Gazette,* and *The Buxton Advertiser.*

THE SPORTSMAN'S EXHIBITION.

"All work and no play" has a proverbial effect upon John's intellectual powers; hence, any attempt to minister to the improvement of means of legitimate recreation possesses something more than merely ephemeral interest, and the amount of ingenuity and skill in the application of science shown in many of the articles displayed at the recently-closed exhibition at the Agricultural Hall certainly deserve some notice here. Amid much that was worth notice we were struck with a couple of novelties in boats; one a paddle-wheel one propelled by treadles; the other a canoe, shown by Mr. Turk, with a shifting keel which could be lowered or drawn up at will; when down, it enabled the canoe to sail and keep well up to the wind. "Galvanised" iron sheds for covering tricycles, forming hot-houses, &c., exhibited by Hayward & Co., appeared very efficient. An excellent novelty in harness, in the shape of Webster's "Patent Aluminium Metal," was shown. Strong and rustless, it not only serves admirably for the decorative parts, but makes bits which leave nothing to be desired. Mr. T. Turner had some excellent hammerless guns, and, what is more of a novelty, a simple movable muzzle for converting an ordinary cylindrically-bored gun into a choke-bore, and *vice versâ*. One of the most efficient joints for fishing-rods that we have seen is the new patent one by the Messrs. Anderson, of Edinburgh. Mr. Slater also exhibited excellent fishing-tackle. The wants of fishermen and others in the way of waterproof attire were amply provided for; a double coat, made by Bates & Sons, for enabling two people to sit together on a dog-cart, &c., and keep dry instead of dripping over each other, and the "Euknemida" waterproof boots may be mentioned in this connection. Carriages, dog-carts, "cycles" of all and every description, materials for cricket, football, polo, tennis, billiards, and games of every description abounded; and we have doubtless passed over much that was curious, novel, and interesting; but we have just jotted down a few of the more noticeable things which struck us in passing. Mr. G. Rees appealed to admirers of sporting art with some really high-class coloured engravings.

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

DARK TRANSIT OF JUPITER'S IVth SATELLITE.

[1687]—That rising observer, Dr. Spitta, of Clapham, has communicated an observation of such interest to me that I am induced to ask leave to put it on record here. Watching the transit of Jupiter's IVth Satellite, on April 18, he noted, as other observers have done before him, that it appeared black while crossing the face of the planet (he had, however, a suspicion of a *brownish* tint for a short time), and that its figure was not circular. The interesting part of his observation, though, lay in the fact that the blackness persisted, even when the satellite was *on* Jupiter's limb, and, in fact, until it had crossed it and was visible against the dark background of the sky. I have myself, of course, seen this same Satellite crossing Jupiter's disc as a dark and irregularly-shaped spot, but it has always vanished as such before reaching the limb, and become invisible with my optical means until it was projected on the sky. William Noble.

Forest Lodge, Maresfield, Uckfield, April 25, 1885.

[As far as I can discover, the observation referred to above by Captain Noble appears to be unique.—Ed.]

PARHELION.

[1688]—While crossing London-bridge on April 21, I noticed a remarkable appearance in the sky at 5.35 p.m. The sun was approaching the horizon, and, on its left, about once and a-half its distance above the latter, was a very luminous spot, shining through some hazy clouds. The spot was highly coloured, red on the side nearest the sun, ranging through the colours of the spectrum to blue on the other side.

On my arrival at Streatham the spot was still visible, but more faint, whilst, on the other side of the sun, at an exactly similar distance, was another like appearance. Were these examples of "mock suns?" Perhaps some of your readers have seen similar phenomena? The sky looked decidedly "windy," and I fear some abnormal state of the air portends a speedy end to the fine weather we have lately enjoyed. John H. Bateman.

METEOR.

[1689]—On Wednesday night, 15th inst., at 10h. 20m., in the east, a fine meteor was observed here, at 50° altitude; colour intensely blue, in a horizontal line from south to north from β Herculis to β Lyræ, about 12° in length; head, apparent size of Sirius; duration of flight, 2 seconds. Was on watch for meteors, being the period for April meteors. In hopes some of your correspondents may have observed it from their point of view,

James Blackwood, Observer for the Scottish Met. Society.

INTELLECT AND THE SIZE OF THE BRAIN.

[1690]—Since Mr. Taunton has forgotten the name of his "very famous German professor," and does not think fit to tell us the name of his "distinguished German doctor," he must not be surprised if we accept his facts only *cum grano salis.*

Have the results of these researches ever been published? If not, we must wait until the full details are given to the world before we venture to estimate their evidential value. If they have

been published, let Mr. Taunton refer us to the published account, so that we know that we have the real facts before us before we begin to draw conclusions from them.

Cool-headed indeed must have been this party of German doctors who, in the midst of war and carnage, could find leisure and opportunity for an accurate estimation of the weight of the brains of their dead fellow-countrymen, and also for a careful inquiry into their intellectual capacity!

But granting that Mr. Taunton's facts are of the highest evidential value, I see nothing in them which would lead me to withdraw from the position which I have taken up in my former letters. I have never asserted that the weight of the brain is the sole cause of intellectual superiority.

I might also point out that weight is not necessarily a criterion of size, which was the word used by me in my last letter. Two brains which weigh the same after death may have been very different in size during life, owing to one being more largely supplied with blood than the other.

Mr. Taunton must also remember that the cerebellum has, in all probability, very little to do with the intellectual capacity of its owner; and, further, that while the anterior lobes of the cerebrum are the instruments of the "attributes that man shares with the higher mammalia," the "posterior lobes are the instruments of attributes peculiar to man, which we fairly may suppose to consist in such mental operations of a purely intellectual character as do not express themselves in bodily actions." (Carpenter's "Mental Physiology.")

Hence we should compare the size, not of the brains in their entirety, but only of the cerebra, or more strictly only of the posterior lobes of the cerebra.

Can Mr. Taunton say which part of the brain his doctor and professor were accustomed to weigh?

Perhaps Mr. Taunton will ask me why I did not in my former letter point out that we ought to take account only of the size of the cerebrum, and not of the whole brain. Let me draw his attention to this fact. In my last letter I did not mention the word "intellect." I was speaking only of general "mental power." And the "intellect" forms only one of the branches into which mental faculties are divided.

If Mr. Taunton will take account of the other mental faculties, he will perhaps find that the result of his professor's researches quite accords with my contention. A. F. OSBORNE.

WEIGHT OF BRAIN.

[1691]—I thought it was generally recognised that the weight of the brain had some general relation to the mental powers of the individual, although many instances are shown to the contrary.

Cuvier's brain weighed upwards of 64 oz., and other brains of talented men have nearly equalled it in weight, while, on the other hand, the brains of idiots are very small.

Tiedemann found the weight of three, ages sixteen, forty, and fifty years, to be respectively 19½ oz., 25¾ oz., and 22¼ oz. Dr. Sims found a female idiot, twelve years old, to have a brain weighing 27 oz. Dr. Allen Thomson has found the brain of a female dwarfish idiot girl to weigh, after preservation in alcohol, 18¼ oz., the average adult male brain weighing 50 oz. and adult female 44 oz., with a few drachms over in each case, so the difference in weight, one would think, would account for the difference of an idiot's capabilities and an average man or woman's.

There is a possibility that the professor's brain may have begun to lose weight, which it is supposed to do after fifty or so, amounting to about 1 oz. during each subsequent ten years. I say "supposed," because the age is not agreed upon.

E. FITZGERALD.

WOMAN'S INTELLECTUAL CAPACITY.

[1692]—In gauging the relative mental powers of men and women, H. Taunton (letter 1668) should not compare women of one part of England with men of another part, but the *élite* of both sexes.

The arrest of physical development at an earlier age and potential motherhood handicap woman sadly. Nor is a higher education likely to improve her position. "The big chests, the massive brains, the vigorous muscles, and stout frames of the best men, will carry the day, whenever it is worth their while to contest the prizes of life with the best women. And the hardship of it is, that the very improvement of the women will lessen their chances. Better mothers will bring forth better sons, and the impetus gained by the one sex will be transmitted, in the next generation, to the other. The most Darwinian of theorists will not venture to propound the doctrine, that the physical disabilities under which women have hitherto laboured, in the struggle for existence with men, are likely to be removed by even the most skilfully-conducted process of educational selection" (Huxley's "Black and White").

But there is a good time coming! What extended education will not effect, the process of civilisation will accomplish. *The tendency of cerebral development is to diminish fecundity* (Spencer's "Principles of Biology"). In future ages woman will compete with man on more equable terms, and may attain the superiority foreshadowed in Lytton's "Coming Race." F. J. C.

DRY-EARTH *v.* HYDRAULIC SYSTEM.

[1693]—I am glad to see a discussion opened in your columns *in re* the above. I have had an opportunity of testing both by actual experience, and must say I much prefer the latter, and think, when properly carried out, it is quite safe.

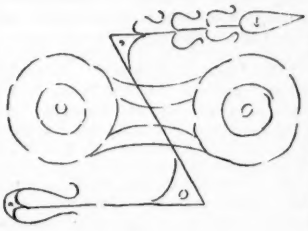
The system at present in use here, and so strongly recommended in your articles on Domestic Economy, is, I grant, perfect in theory, but in practice many objections arise.

My objections are:—(1) Their very bad smell. From the fact that in practice they seldom get their proper quantity of ashes, and that small quantities of excrement occasionally find their way to the side of the receptacle—this is very bad; and, after a time, the adjacent brickwork seems to absorb the smell, and to give it out when stimulated by heat. That this is no fancy picture, a walk along a Manchester back-entry will convince any one. (2) The very objectionable smell arising from the removal vans of the town, of which I have met as many as twelve in twenty minutes' walk. (3) Their great inconvenience, owing to the use of a receptacle; they cannot be placed in the house, for, although the devices recently shown in KNOWLEDGE may be right enough in theory, in practice the first objection applies to them all, with the additional one of the inconvenience of removing the receptacle every day devolving on some member of the household instead of on the town's men, as at present.

During a residence of two years here I have never heard a good word said for them by any disinterested person, and, so strongly are these objections felt here, that all modern houses are being fitted with w.c.'s, it being found almost impossible to let them unless so fitted. F. W. B.

Manchester, April 18, 1885.

INSCRIBED MONOLITHS.



[1694]—The sculpture on the stone shown in letter 1671, p. 332, is evidently what is known among Scottish antiquaries as the "spectacle ornament." It is, I believe, peculiar to Scotland. The accompanying drawing is taken from a stone in the Museum at Edinburgh, which was found imbedded in the "Castle Hill of Kintore." E. C. R.

[1695]—In reply to letter 1671, it may interest Mr. Thomas Black to learn that stones inscribed with concentric circles, spectaclelike figures, crescents, &c., are not uncommon in Aberdeenshire, and are most frequently met with along the east coast of Scotland, from Fife to Caithness. They have been sometimes found in connection with the burial-places of our rude forefathers, and the covering slabs of stone-cists have been found inscribed with them. In my rambles I have obtained rubbings of eight or ten within a radius of fifteen miles from the part of Aberdeenshire I write from. The figures are invariably inscribed on rude blocks often weighing several tons, and they show no trace of dressing. Hereabout the rock selected is generally a hard diorite left by drift-ice.

The meanings of the figures are not known; but, from the fact that upwards of a hundred specimens have been found throughout Scotland, it is inferred that the meanings were not local, but rather symbolised some general belief or ancient myth. They evidently form the earliest attempts at sculpturing by the people of this country, and from the fact (among others) that a rude cross has sometimes been found inscribed on the obverse side, they may be ascribed to a period from the eighth to the tenth century.

What are known as "cup-markings" are entirely different from the spectaclelike figure drawn by your correspondent; but whether there is any connection between them has not yet been, and may probably never be, determined. In what county is Newtyle,* where Mr. Black's inscribed monolith may be seen? J. G.

[* It is in Forfarshire—near Coupar Angus.—ED.]

LETTERS RECEIVED AND SHORT ANSWERS.

Miss E. Dalton offers to supply Mr. Gansby with a male salamander. She has, she writes, had a pair for seven or eight years, has been very successful in rearing the young ones, and is anxious to find a happy home for them.—Thomas Ayers. *Suum cuique.* If any published discovery of yours has been utilised in recent scientific expositions, of course you ought to have the credit of it.—Protea. Your question, put without qualification, has very little meaning. The comet of 1729, at its nearest to the earth, was more than 368,000,000 miles from us, and was visible for six months! A comet in 1847 was followed until it was three and a quarter times the distance of the earth from the sun. When first perceived (with difficulty) by Donati, the comet of 1858 was 240,000,000 miles from us. No comet has been, so far, seen at the distance of Jupiter. Biela's comet was seen for the last time in 1852. The nebulous fragment picked up by Mr. Pogson at Madras in 1872 was two months behind the computed time of this comet, so that astronomers are unanimous in the belief that this was *not* a part of comet Biela.—E. L. G. I can only regret, sincerely, that you attach such conditions to furnishing "D. L. X." with the formula for the profile of his gnomons—because I can have none of them. "R. A. P." had as much—or as little—to do with the replies as the Mahdi himself. Like other paradoxers, you seem to be possessed with the extraordinary idea that you have a direct equitable claim to occupy the pages of a scientific journal with expositions of your thesis, and thence to defy the universe to disprove it. If you think that a watery comet (whatever that may be) caused a deluge on the earth 5,000 years ago, why not ventilate so very philosophical a hypothesis before the Geological Society at Burlington House? You would there confront scores of men infinitely more familiar with traces of diluvial action on the earth's surface than you can possibly be, and the value of your "evidence" would be shown by the result of the discussion which would probably ensue. If a majority of men who have devoted their lives to the study of the earth's crust coincided with you, you should have space and to spare here to proclaim your triumph. If, on the other hand, they regarded the "Watery Comet" as a mere frantic attempt to bolster up an untenable legend, then the question would be settled at once and for all by the only persons entitled to decide *ex cathedrâ* on it.—Alfred Capper. Received with thanks.—H. A. B. When Mars is favourably situated in opposition, his polar snow cap may be perfectly well seen with a three-inch achromatic. Jupiter's belts are at all times visible in such an instrument. *A fortiori*, a splendid view of these phenomena is obtainable in an eight-inch reflector. The Milky Way consists of millions of stars—not necessarily, however, large stars rendered seemingly minute by their great distance. See "The Universe of Stars." A purist would say "each side of the way," and not "either."—A. J. W. I have asked "F.R.A.S." to reply to your query, and he says, "As far as my experience extends, Jupiter's fourth satellite always appears dark in transiting the face of the planet, but it enters on to and leaves the planet's limb as a more or less bright spot. Your correspondent's account of the dimness of the satellite when projected on the dark sky after quitting Jupiter's face is very interesting."—J. Webb. What "F.R.A.S." means is that the planet has got into an unfavourable position for the observer, not that it is absolutely *invisible*. How high is it above the horizon now when it is dark—say at 8h. 30m.? —Chas. A. Loxton suggests that Mr. Butler should furnish the etymology of the scientific names given in his papers on "Our Household Insects."—Dr. Lewins. Much that you say is beyond contradiction. To select a single illustration, I feel quite as strongly as you do how utterly baseless a figment is that of a "vital principle," and have said before here that it would be as wise (or as foolish) to call in a "watch principle" to explain the action of a chronometer. Upon such a question as this discussion would clearly be permissible. But an impartial re-perusal of your own letter must show you that you trench upon questions upon which argument could not be admitted here without wholly altering the character of this journal.—W. R. Kennan. You will find that the typographical errata to which you invite my attention were subsequently corrected. When the papers are reprinted, this correction will, of course, be made in the text. On April 18, at 11h., Jupiter's satellites appeared in an ordinary inverting astronomical telescope to the left of the planet in this order: IV., II., III. (below), I. (above).—Rev. Charles Voysey. My sole end is, as far as in me lies, to be rigidly just and impartial. Many thanks; it is scientifically accurate as it is eloquent.—M. H. E.—Thanks. The question was not whether "a farinaceous diet . . . . is (or is not) best suited to the tropics," but whether it is (or is not) the fact that vegetarian races have invariably succumbed to flesh-eating ones. Of course, if the *Pioneer* chooses to assert that the vegetable-eating Hindu is the incarnation of bravery and soldier-like qualities, and the "modified meat-eater," the Sikh, is an arrant cur, *non est meum contra auctoritatem Senatûs dicere.* For aught I know the editor may possess facilities for deciding the question on the spot, and by means of a "set-to," between a Sikh and a Hindu in his own compound, to gauge their respective powers and pronounce definitely on them. But I fancy that I could find an Englishman to thrash the couple of them if necessity arose. —F. W. Rudler. Received with thanks.—Uncle John. Precisely as though travelling in an absolute vacuum.—J. B. Rundell, in sending me his new Stenographic Alphabet, adds that his system will be explained to the Shorthand Society, 55, Chancery-lane, at 8 p.m., on May 6. We shall hear what professional shorthand-writers think of it then.—W. Mathews. I can hardly find space for a reply to an irrelevant criticism in another journal.—E. Jackson wishes to be informed how "Crystal Soda" is made for washing purposes.—Robert Millar. I am ignorant of the book you name, but Williams & Norgate, of 14, Henrietta-street, London, published one in 1877 with the same title.—S. Gr—N. I don't know myself! Inquire in either of the localities in which the use of the word was presupposed. —Holmdale. I cannot tell the "exact" variation of the compass at Cheltenham; but, if you assume it to be 19° west of north, it will be more than sufficiently accurate for your purpose. You can hardly obtain a meridian line by means of Polaris without more elaborate appliances than you possess. If you are not satisfied with one obtained by compass, you had better wait until the 20th or 21st of June, when the declination of the sun remains sensibly the same for twenty-four hours. Fix a knitting-needle truly square to a perfectly flat board, and round the point at which the needle enters the board describe a number of concentric circles. Level your board accurately, and your needle will be perfectly upright. About 8 a.m. notice where the shadow of the top of the needle touches one of your circles, and make similar observations for the next hour or two at intervals, carefully marking the points of contact of the shadow with the circles. At equal intervals after noon repeat these observations. Join the pairs of points thus obtained, bisect the lines joining them, and through these points of bisection draw a line to the base of the knitting-needle. This last line will coincide with the meridian. Negretti & Zambra, Casella, or other meteorological instrument-makers are the people to consult about an anemometer.—Musafir. Observations of occultations of stars by the moon, if accurate, do possess scientific value, both as affording means of determining longitude and of correcting the lunar tables; but their reduction is most operose, and involves a really tremendous amount of calculation. If you can obtain a copy either of Chauvenet's or Loomis's "Practical Astronomy," you will soon see what you have to face; a remark which equally applies to ascertaining longitude from a solar eclipse. The reduction of lunars is far more simple. If you have observed any occultations of stars, at accurately determined local times, at the moon's dark limb, you should transmit them to England for comparison with the corresponding ones at Greenwich. Moon-culminators are beautiful in principle, but fail in practice. A large number must be taken both preceding and following the moon, and with both of her limbs illuminated in turn, to get a result worth anything at all. *Experientia docet.* Your suggestion, *re* mean time sun-dials, that the gnomon might be constructed, so that one edge would serve for one half of the year and the other for the remaining half, seems worthy of attention; but I am personally ignorant what form such edges should theoretically assume.—David Glasgow, Jun. Thanks for your offer; but you deal with subjects on which two —in fact, three—of the permanent staff of this journal are competent to treat. On receipt of a stamped and directed envelope, your communication shall be returned. Your letter, dated the 16th ult., did not reach me until long after that.—Miss Gertrude Nash. Scarcely suitable for a paper devoted wholly to science. It will be returned on receipt of the regulation stamped and directed envelope. Reviewing already in skilled hands.—Commentator. I heartily agree with you. "Poor old England!" is certainly a solecism in the mouth of any Canadian, gentle or simple. With our resources, material, intellectual, and moral, we may gauge such an utterance at its true value. Perhaps, though, the man who employed it was thinking of the *Government*, and not of the mighty British Empire. He may have been reading the French, German, Austrian, or Russian newspapers, and supposed that their comments referred to the mass of Englishmen generally, instead of to a wholly insignificant fraction among them. —F. W. H. We are, as you say, absolutely in accord; but you will see that I have perforce closed the discussion here. You have contributed too much of value and importance for me ever to complain of your "persistence."—Aug. J. Harvey suggests the appointment of public interpreters at all ports, terminal railway stations, &c.

There is every possibility of the Clifton Extension Railway to Avonmouth being opened for passenger traffic during the summer.

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (KNOWLEDGE being a popular magazine) than is accorded by the most excellent trade journals.

A NEW TYPE-WRITER.

A NOVEL Type-writer has just been privately exhibited which possesses some important advantages over any contrivances of the kind previously introduced. The letters and numbers are arranged in the form of a dial about four inches diameter. The action consists in bringing a point worked by a handle over a hole in the edge of the dial and then depressing it. The character required is then printed on the paper. The types are arranged radially inside a small cylinder under the dial. The handle, which works on a pivot eccentric to the dial, presses down a stud in the centre of the dial. The lower end of this stud pushes back a spring, the recoil of which causes the type to stamp its character on the paper. The characters are all stamped with great regularity because the impression is not produced by the direct action of the handle (which, without great practice, would necessarily vary), but by the recoil of a spring which is always sent back to the fullest extent. The action of a spring under such circumstances must be uniform, hence the evenness of the impressions.

Placing carbonic copying-paper under the writing-paper will enable the operator to get from three to six copies of the type-writing. By using a spring capable of striking the type with a little greater force twelve or more copies may be easily obtained. I have seen twenty perfect copies produced successfully in this manner. From the facility with which a number of copies may be obtained the Dial Type-Writer will be very valuable for press purposes.

The new apparatus has many advantages over the Remington Type-Writer; it is about one-quarter the size, and should, I think, be made and sold for one-quarter the price. It gives both capitals and small letters without increasing the complexity of the apparatus. The inking arrangement is the best and simplest yet introduced. The machine will print for many days with once inking the small rollers, and it is only the work of a minute to recharge them with ink; yet the inventor has a simple plan by which he intends to make them self-inking for weeks or months together.

The adoption of type-writers in place of writing would be of incalculable benefit. All correspondence and MSS. generally would be much more portable and legible. There would be an end of writer's cramp, and the eyesight both of writers and readers would be saved. Writing in a railway train, now a most difficult task, may be accomplished with this machine with perfect facility.

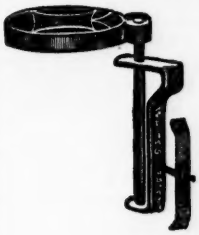
The machine is not yet for sale. The inventor wishes to dispose of the invention to some one who will make it in large numbers, so that it can be brought into the market well made and at a low price.

The present machines have been constructed under the superintendence of Messrs. Lineff & Jones, of 9, Buckingham-street, W.C., for the inventor, Mr. Peacock, of 47, Fleet-street, E.C., who will exhibit them by appointment.—*Communicated by J. Browning, F.R.A.S.*

SLATE CLEANER.

[Patent 8,735. 1884.]—This article, introduced by Mr. Vickers, of Market-street, Leeds, consists of a small tin box, containing a piece of good felted cloth, which is wetted, and then used to clean the slate. It is made to retain sufficient moisture to last three or four days, and is claimed to be cleaned by simply soaking in cold water. A lid is provided to prevent the water evaporating or damping the clothes. The box measures about 1¾ in. by 1¼ in., and is about ⅜ in. deep. The adoption of an article of this kind is certainly preferable to the ordinary and comparatively dirty methods generally in vogue amongst school children. A modification of the cleaner is made for use with blackboards.

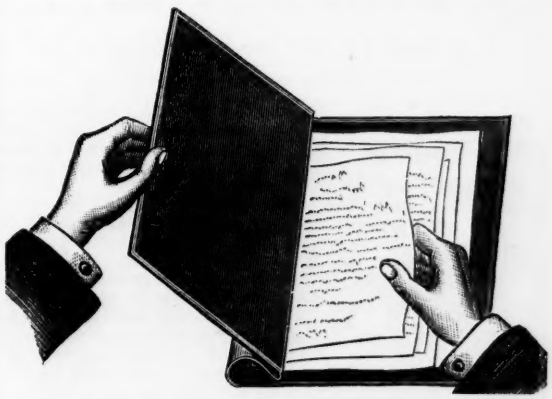
SWING TRIVET AND CLIP.



[Patents Nos. 2,432 and 8,401. 1884.]—Mr. White, of 45, Coleridge-street, Kensington, Liverpool, has devised this simple and efficient piece of domestic apparatus. It consists of a bent strip of iron, which rests on the top bar of the grate, and passes down on the inside of the subjacent bars. Another piece of metal embraces the latter bars on the outside, the two strips being firmly fixed by means of a bolt kept in place by a screw nut. The trivet consists of a skeleton iron plate attached to an iron rod passing through an extension of the upper portion of the clip, and resting upon a similar extension at the lower end. The trivet is free to move horizontally, and, of course, allows the kettle or other utensil to be placed over the fire without resting on it, and so drawing it.

SPRING LETTER-CASE.

[Patent No. 9,053. 1884].—This article, introduced by Messrs. F. Brampton & Co., of Oliver-street, Birmingham, is very simple in construction. It consists of a pair of well-covered boards con-



nected by a back, composed of a broad bent spring. Letters or papers are placed on the lower cover, and are held securely by the pressure of the spring-back. The upper cover moves freely

and, when allowed to fall in its place, keeps the contents of the case clean. The other advantages pertaining to the automatic spring letter-case are that the papers are not perforated or otherwise injured; they are kept flat, there is nothing to get out of order, and a pile of papers two inches thick can be readily inserted, and abstracted without necessarily upsetting the others.

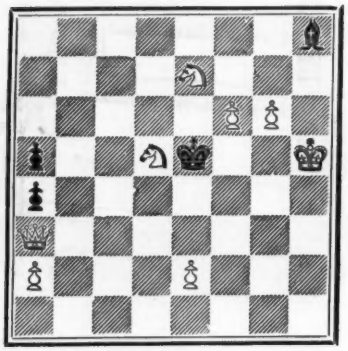
Our Chess Column.

By Mephisto.

PROBLEM No. 154.

By B. G. Laws.

Black.



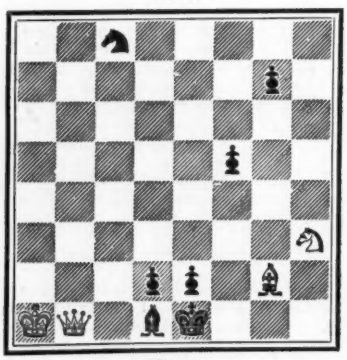
White.

White to play and mate in three moves.

SELECTED PROBLEM No. 155.

By S. Lloyd.

Black.

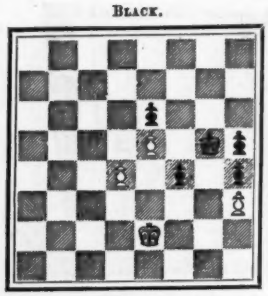


White.

White to play and mate in three moves.

USEFUL END GAMES.

Black.



White.

No matter who moves first, the game ought to be drawn. But, as will be seen, care and judgment are required to maintain the opposition.

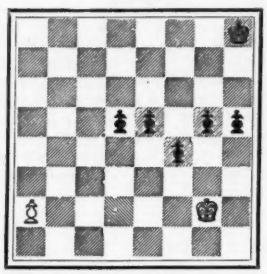
1. K to B2

If White plays 1. K to B3 he must lose, as Black will reply with K to B4, gaining the opposition, and next move White must lose a Pawn. If Black had the first move, and would play K to B4 he would be similarly positioned, and lose the opposition by White playing 2. K to B3, K to Kt4. 3. K to K4, &c.

K to Kt3
K to B2 K to Kt4

and the game is drawn. The White King dare not play to B3, or the Black to B4, as that would give the opponent the necessary opposing position to win.

Black.



White.

White having the move will draw.

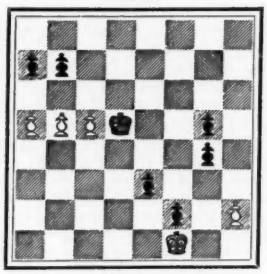
1. P to R4 P to Q5
1. P to R5 P to Q6
2. K to B sq. P to B6
3. K to K sq. P to Kt5

the only move to save the game. If P to K5, White wins by 4. P to R6.

4. P to R6 P to B7 (ch)!
5. K × P P to Kt6(ch)!
6. K × P P to Q7
7. P to R7 P Queens
8. P Queens (ch)

and the game will result in a draw, as White will either gain a series of checks, or win one of the Pawns soon.

Black.



White.

In this position, White having the move, will draw, as follows:

1. P to B6 K to Q3

If P × P, then White wins by 2. P to Kt6.

2. P × P K to B2
3. P to R6

and the game is drawn.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

M. T. Hooton.—3. P × R (Kt) mate.

An interesting lecture on Greenland was given in the Royal Victoria Hall, Waterloo-bridge-road, on Tuesday, April 21, by Dr. P. H. Carpenter, of Eton. He first described, with the help of lantern illustrations, the situation and general appearance of the country, which has an area of 800,000 square miles, but is inhabited only on the west coast, the east coast being so blocked with ice that ships can reach it only in a mild summer, while travelling in the interior is only possible with dog-sledges. The lecturer described the huge glaciers or streams of ice which, formed by the compression of the snow on the mountains, descend through the valleys to the sea. Sometimes huge masses break off from them and form icebergs, one of which was stranded in Baffin's Bay, in water half-a-mile deep, and was calculated to contain 1,000 million cubic yards of ice. Many of the fjords are filled with bergs thus formed, which are very dangerous to ships.

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NOTICES.

Part XLII. (April, 1885), now ready, price 1s., post-free, 1s. 3d.

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